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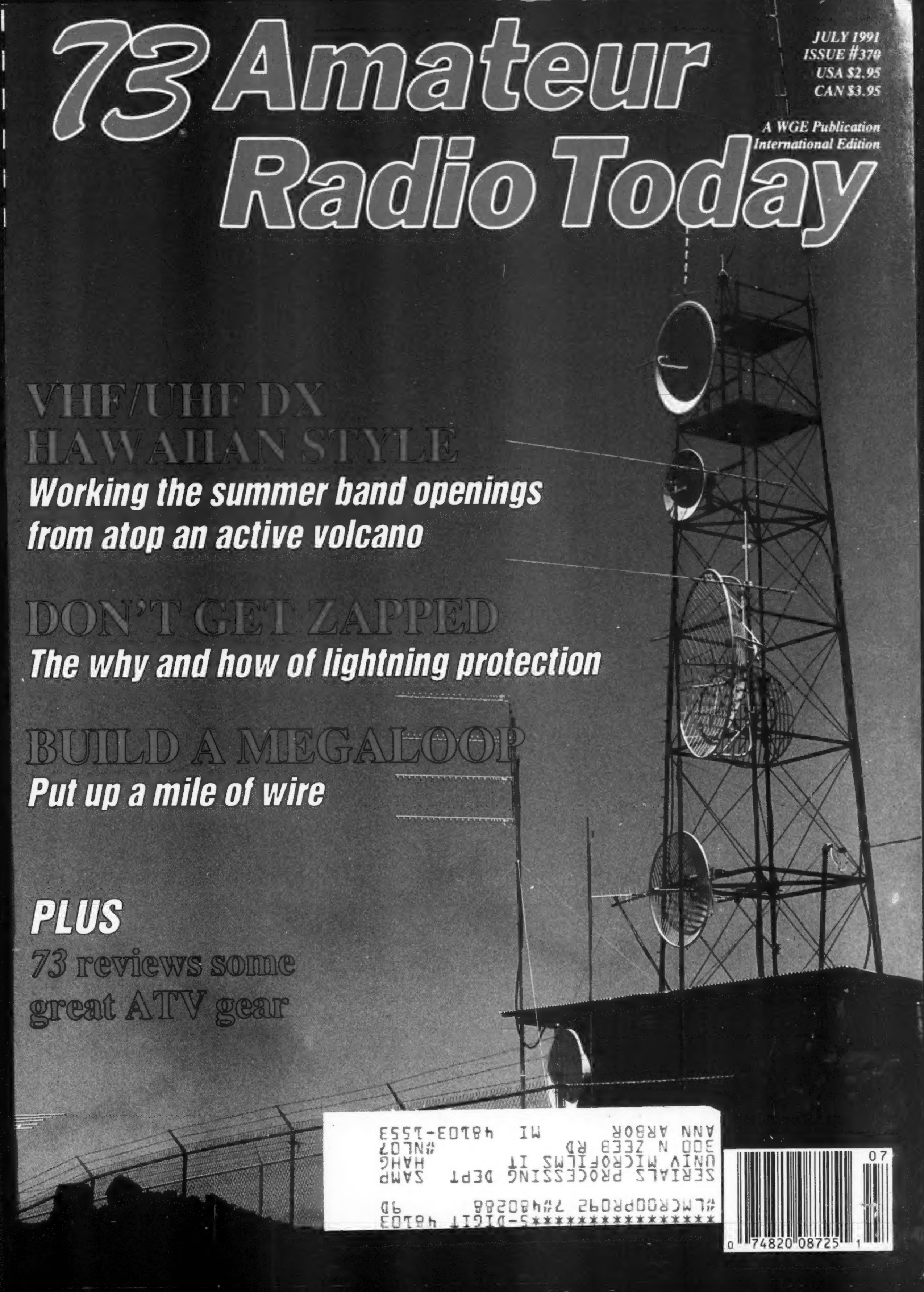

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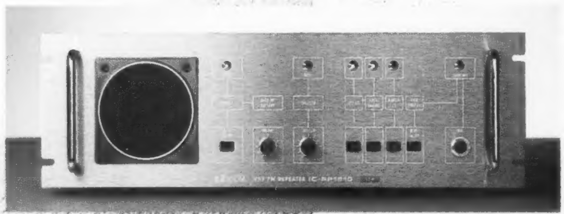

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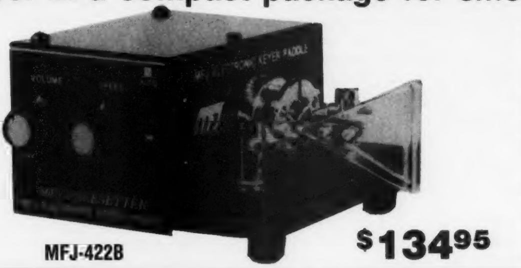

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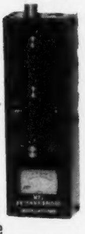

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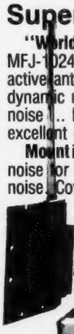

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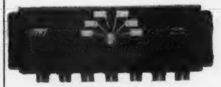
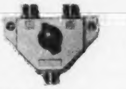


$34.95 MFJ-1701



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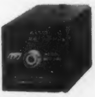

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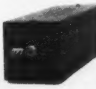

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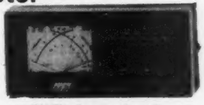

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LETTERS

From the Hamshack

Dan and Sue Cashin, Havertown PA As semi-regular readers of *73*, we'd like to let you know we find it an interesting publication. We especially enjoy your "Never Say Die" column. It's thought-provoking, interesting, and just plain good common sense!

We've been considering getting our ham tickets, but have not quite decided what the hobby will do for us. We're dedicated SWLers and enjoy the world at our fingertips. What is the hobby of hamming all about? Is it a world of contests, quick contacts, and QSLs? Is the soap opera we hear on 14,313 typical of ham nets? What types of nets are there? This is a high cost hobby, and we've not hit the lottery yet.

I'd like to propose an idea to go along with your new *Radio Fun* publication. Why not a net like ANARC's Sunday morning SWL net? There could be gateway stations to answer prospective amateurs' questions. It could serve as a place where interested people could get straight answers from people in the hobby. ANARC is on 7240 LSB, 10 a.m. East Coast time, with Bob Brown KW3F as net control.

Keep prodding and pushing for progress, and who knows, maybe we'll get to talk on the air some day soon.

Amateur radio is mostly about a half million or so people around the world who are having fun. Some do it with nets, talking to people with similar interests. Some chasing DX and fighting the pileups. Some with a hand transceiver on their belt, keeping in touch with friends in the area. Some in club work. Some in talking through our several satellites. Some in bouncing their signals off the moon. Some in building kits and designing new equipment. Some in microwave experimenting. Some in exchanging messages via their computers and packet radio. Some using radio teletype. Some with slow-scan TV. Some with regular fast-scan TV. Some send miniature TV cameras and transmitters up in balloons. Some get together on Saturdays and try to find hidden transmitters. Some get involved with contests. Some go to rare spots around the world and operate for a few days, making thousands of contacts. Some spend their time teaching newcomers. Some write long editorials. Amateur radio is a whole bunch of hobbies. Oh yes, some get their fun by getting on 14,313 and cursing out the others. Some send endless "information" bulletins on 14,275. One ham recently chose to try and mess up the DC police... and got arrested for his trouble. Our hobby has something fun to do for every temperament.

Money? It's easy to get once you get the hang of it. I find the harder I work, the luckier I get.... Wayne

Jeff Wilson N9IMJ, Carlinville IL I read your magazine regularly, and I can honestly say that it is the best magazine printed in the field of amateur radio. I especially enjoy your editorials, and in particular the ones that display a "get up off your duff and do something for your hobby" motif. Frankly, I'm as lethargic as the next person, but I cannot understand why any ham who is perfectly capable of it won't in some fashion attempt to better the hobby or promote amateur radio to the public.

The area in which I reside has quite a few amateurs, but very, very few active amateurs—ones who still have and use a radio. About a year and a half ago, eight of us active hams formed a club. Despite our small size, we have managed to organize Field Day in an area where the public could see us and ask questions. Every year we provide communications for the Multiple Sclerosis Walk-a-Thon. Our club gives demonstrations for interested groups, and lately we have offered a class in amateur radio to about 12 people. I can't speak for the others, but I know I put in 3–5 hours a week on the class alone, and if only one person passed the test, I would still consider it time well spent.

I realize all this isn't very much, but if a club of eight members can do this, a club with 200 members should be able to do at least twice as much.

Richard L. Collins WB4DBV, Camilla GA I thought I'd write you about these two stacks of magazines I have. One stack sits so nice on the shelf, and the other is a job to get organized. The one that sits so nice is *QST*, and the other is your *73*. Why? Now after many long hours of deep thought, I've found the answer. The *QST* is read once, and the *73s* are read and re-read many times over. Keep up the good work. TNX fer a great magazine.

Thanks for taking the time to write—and glad you're enjoying 73.... Wayne

Martin E. McCoy WB0TCZ/7, Cheyenne WY The last "new" magazine I subscribed to was some Timex/Sinclair rag that sent me two issues, then promptly disappeared from the planet. I'm not worried, though. You seem to have a knack for doing things right!

I'm signing up for your new magazine, and if it looks good, I'd like to get a subscription for High School III. High School III is an alternative high school here for kids who aren't able to remain in a "traditional" high school. I've visited HS3, and they look like a great bunch of kids who are making the best of what they have.

Their library is very pitiful—there is no Dewy Decimal 621 section (electronics). I'm going to try to rectify that, and even try to introduce some of the students to ham radio. Wish me luck!! Looking forward to your new mag!

Steven Rosenberg KC6FYL, Sherman Oaks CA I just wanted to drop you a note to tell you how much I've been enjoying *73* lately. I upgraded to General a few months ago, and I moved to an apartment QTH. April's issue was great. I built Frank KB4ZGC's "Artificial RF Ground," and now wonder what I did without it. The simple construction projects are great. From the April and May issues alone I'll be busy building for some time to come—I'm getting ready to put the Color Burst Ether Duster together for some mountaintop QRP.

Thanks for paying attention to apartment ops with articles on indoor antennas. May's "Apartment Antennas: A Challenge," was very helpful. You're definitely improving *73*, and I hope you keep the technical articles coming. I'd love to see a home-brew SSB rig—call me a glutton for punishment.

I hope the new codeless Technician license will bring a new kind of ham to the local repeaters, as well as a bunch of computer types to packet who wouldn't take the plunge before. I'm looking forward to *Radio Fun*—I hope it can do the job and help get a whole lot more people licensed and on the bands.

Oh, I used an Uncle Wayne tape for only a couple of hours and I passed the 13 wpm with no trouble and virtually no study. I didn't think it would work, but it's almost subliminal. I couldn't copy anywhere near 100% on the 20 wpm tape, but when the exam came, it was like a walk in the park! I don't know quite how it worked, but it did.

Glad the code tape helped... look for you on 20m now.... Wayne

Bill Pitts KC4WJG, Troy AL Recently my interest in amateur radio was rekindled, and I made a firm decision to get my ticket. The war in the Persian Gulf made me realize that electronic communications are still important, and I wanted to be able to do anything I could to help.

I passed the tests and made Tech, but I want to tell you that most of the people who become interested don't get their licenses. They become discouraged and lose interest. I think I have a very good idea why.

I had to travel 50 miles to find a ham magazine (*73*, of course)... about a week [later] I got a list of clubs in the area that offered exams. With a Radio Shack Novice and Tech theory book, which I also had to travel 50 miles to find, I studied for three weeks. The ARRL test was not exactly streamlined (it took three hours), but I passed on the first try.

While waiting for my ticket to arrive, I located two other hams where I work. One had retired and wasn't very active on the air. He told me about the local club, and I attended the next meeting. Guess what—there was no program and no planned activities, however there was a good discussion on how well the military operators could copy code during WWII. When the time came for the next meeting, I went to where the first meeting had been, but no one else was there. The location had been changed, and they thought everyone knew about the change. I had left my phone number with the club president. Since I didn't have my license, I couldn't ask anyone on the air where the meeting was. I had met two prospective hams at the first meeting who were studying for their no-code tests. They didn't pass. I wonder if I will see them again.

I have been reading *73* since the November issue. I really enjoy your magazine. The first thing I read is the letters, and the second thing is your editorial. I have to agree with you. There are a lot of people in amateur radio who don't want things to change. They may be nice guys, but they are behind the times. Perhaps I am passing judgment too soon, but no one has invited me to see their shack. No one has offered to let me listen in when they go on the nets, or shown me how their rigs operate. Is ham radio a closed society, or is it possible that most of the older hams are simply unaware of the needs of new hams?

I'm not giving up. I'm studying for General right now. I'm also studying your magazine. I want to build at least some of my equipment. I work for an aircraft manufacturer in the electrical and avionics fields, and I work with VHF and UHF radio regularly. I also have worked with computer hardware and software for many years. I taught myself to program in several languages. I can't wait to try packet and some of the other digital modes. What I'm trying to say is that I'm not stupid, and I think I could make a significant contribution to the local club, but they don't seem to care if I or anyone else gets a good start. If you could publish some articles dealing with simple receivers and transmitters, and some of the accessories to help operate the shack, I'm sure it would be worthwhile. If the old-timers won't teach us what to do, maybe your magazine will.

Bill, maybe we should start publishing the names of rotten ham clubs who are doing all they can to hurt amateur radio. We could also publish the names and callsigns of the club officiers. Maybe we can shame them into doing something... or at least get them to resign and let someone with a pulse take their position. Congratulations on getting your license. Look for me on 10m.... David N1GPH

J. Frank Brumbaugh KB4ZGC, Buffalo NY All authors appreciate comments and requests for additional information about their published articles, but those requesting such information should think about the cost of postage—not just for the one letter they hope to receive, but to consider that a number of other hams have also written the author for information—and enclose an SASE as an act of courtesy. The author's time and talent go into these replies, which he is pleased to do free of charge—but please, don't expect him to pay your postage bill as well. An SASE will guarantee a reply. I am 70 years old, living on very inadequate social security checks, and just can't afford to pay postage for those hams who want something from me but who lack the courtesy to enclose an SASE. I do not like to disappoint anyone, but I have to be realistic.

Thanks for the reminder, Frank. All writers appreciate an SASE—a self-addressed, stamped envelope. *When no SASE is enclosed, many writers do not answer requests.... Linda KA1UKM*

Tom Spellman KB8EOG, Leetonia OH I must confess, I enjoy *73*! The features on the latest equipment, the well-done projects. I would like to see some sort of goof-proof projects designed to help you learn something, so I can get my three kids involved more. They are primed by the things they see me do with amateur radio, and I catch them thumbing through *73*. They do ask questions. Yes, there are young people interested in ham radio. Yes, the children are interested in computers, science, and space. The middle child, 13-year-old Heather, did a science fair project on OSCARs. We can keep the hobby growing with a bit of encouragement to these kids.

Keep blowing the whistle on those lead-bottomed foggies who wouldn't share a frequency with a youngster even if they knew they would lose it because it isn't used (220).

Paul KI4CH, Chattanooga TN Just wanted to let you know how much I like your magazine. What I like are the articles on how to build it yourself. One of my favorite columns is "Above and Beyond." I've been a ham for about 22 years and have been wanting to get into working with microwave. Another column I like is "ATV." I'm happy to see that you don't use over half of your magazine writing about contests. Keep it technical, how-to, build-it-yourself.

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JULY 1991
Issue #370

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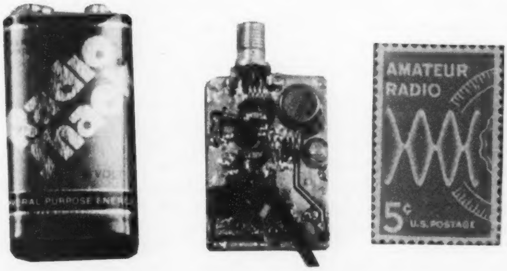

An ATV transmitter smaller than a postage stamp . . . see page 9.

Cover: The KH6HME VHF/UHF beacon site at the 8200′ level of the Mauna Loa volcano, Hawaii. Photo by Gordon West WB6NOA.

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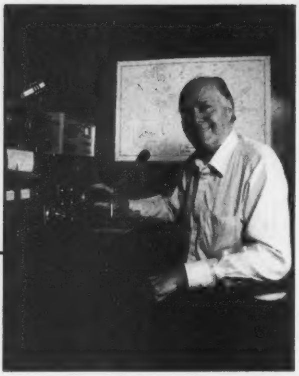

License Fees?

First, thanks to all of you who sent me clippings from newspapers and magazines about the FCC's plans to auction off the spectrum to the highest bidders. Anyone like to guess what country starting with "J" will probably end up owning everything?

In line with this thought, the question of license fees for amateurs has reared its ugly head again. Yes, I know, the knee-jerk reaction is to fight furiously to keep getting the free ride we've been enjoying. After all, I can hear you trying to ask me seriously, don't we provide communications during emergencies? Yep, sure, sort of.

And don't we train people in technology so they'll be available during wartime? Come on, you don't really believe that old baloney, do you? We haven't been able to provide any useful fodder to the military since WWII, 50 years ago. Yes, we were extremely valuable then. But our ham gear today is so far behind in technology that it's pathetic. We're generations behind and falling further back every year. Heck, we've still got some old coots who honestly believe that CW still lives. Talk about fossils!

Heck, if any Gulf War communications equipment comes onto the surplus market, most of us wouldn't have a clue about what to do with it. What are you going to do with spread spectrum surface mount technology microprocessor controlled radios?

Let's not try and use bluster and exaggeration to keep from paying our share this time. In fact, I suggest we go the other way and not just endorse the idea of license fees, but ask the FCC for even higher fees than have been suggested.

Higher fees? The man's gone daft in his dotage. Hams pay money? Everyone knows hams are the cheapest, most miserly group yet to appear on this old earth. Every ham knows that hams long ago won the concept of cheap away from the Scots. I'm exaggerating? Oh yeah? Ask any ham dealer how much I'm exaggerating. Any of 'em. You'll hear war stories you won't believe of cheapness gone berserk. We're talking world class cheap. We're talking hams who will spend three days shuttling between ham dealers at Dayton to drive the price of a new rig down another two dollars.

Wayne's Proposal

Look, since several of you have begun to notice the lack of youngsters in our hobby, and I think that most of us will agree that socking a young newcomer with a high entry fee isn't too clever, I propose that we ask the FCC to not charge hams under 21 any license fee. That make sense?

Yes, I know, the kids today are sporting $100 sneakers, even though they've never even learned to tie the laces. Perhaps we should encourage "Sesame Street" to do a special on shoelaces.

And I see their expensive designer jeans (with the knees torn out). And their Nintendo games. But if you stop and think about it, the kids with the most money are those running drugs and may not be exactly the kind of kids we're looking for. Even if they did get ham licenses we wouldn't understand them over the air since they speak some strange dialect made up largely of one 12-letter word.

The FCC, to simplify their tremendous work load (am I being sarcastic?), now deals out 10-year licenses. That's okay with me. Now I can forget to renew my license every 10 years instead of every five. But that tends to escalate any nominal yearly license fee into fairly large numbers.

I don't think any of us who are actually using our license would argue that we get $100 worth of enjoyment out of it a year. But lordy, that's $1,000 for 10 years. Holy moly! Panicsville.

A $3-a-year fee has been proposed. Well, since I'm suggesting that we let the kids in free, how about the rest of us ponying up a crummy $5 a year to make up for the difference? That's $50 for 10 years. That's about what a dinner for three costs if one person doesn't eat. Even cheapskates like me find a lunch for four goes over $50. Maybe it's the dessert that does it.

Even retirees should be able to eke out $50 for the privilege of irascibly driving the rest of us bananas with their endless exposing of the vacuity of their lives for the next 10 years.

Perhaps we should put in a proviso that our widows can apply for a refund for the unused portion of our fee in case we win our treasured Silent Key certificate before our license runs out. I had a letter from an XYL saying her husband had died that morning and she'd like a refund on his *73* subscription.

What to Do

This is the hard part. It means you've got to find someone you know who can write and get them to do some letters for you to sign urging the FCC and the appropriate senators and congressmen to make that a $50 fee for 10 years, with no fee for anyone under 21. I'd suggest you write the letters yourself, but I've been asking you to write to me for more than 30 years and I haven't heard from you yet, so it's obvious that . . . etc.

Of course I realize that, since you agree with me 100% of the time, there isn't any real urgency in your writing. After all, as long as I don't hear from you, I'll know that you are in total agreement with me. Right? Yes, I truly believe that. Nothing else makes any sense.

The FCC's Secretary gets mail at Washington DC 20554. Your senators and the senators on the subcommittee involved with this mess, Ernest Hollings (D-SC) Chairman, Daniel Inouye (D-HI), Dale Bumpers (D-AR), Frank Lautenburg (D-NJ), Jim Sasser (D-TN), Warren Rudman (R-NH), Ted Stevens (R-AK), Mark Hatfield (R-OR), Robert Kasten (R-WI), Senate Office Building, Washington DC 20510. Reps. Neal Smith (D-IA) Chairman, Bill Alexander (D-AR), Joseph Early (D-MA), Bob Carr (D-MI), Allan Mollohan (D-WV), Nancy Pelosi (D-CA), Hal Rogers (R-KY), Ralph Regula (R-OH), Jim Kolbe (R-AZ), House Office Building, Washington DC 20515.

The easy approach is to write your letter on a computer and then just change the salutation as you print it out for each senator or congressman. Oh yes, please run off an extra copy of your letter for me.

Living Longer

Lost some of your zest for amateur radio? Maybe it's time you got out of your old rusty rut and tried something new? Even the best of things get old after a while. Yes, even sex . . . unless you find a new partner. That seems to perk up even the oldest of codgers. It sure upsets their wives, though.

You know as well as I that it's having interests and goals that keep you alive. This is why so many men die shortly after retiring . . . retiring to enjoy their "golden years." Some gold. They should be called the wooden years, because that's the box they're in . . . or else a small vase on their widow's mantel.

Through *73* I can lead you to water, but I can't make you drink, no matter how much I hoarse around. Or hearse around. We can run articles telling you how much fun packet is, but we apparently can't get you to give it a try. Ditto slow-scan, RTTY, moonbounce, DXpeditioning, QRP, and so on.

Right now the biggest need our hobby has is not for you to keep yourself alive, mumbling inanities endlessly on 20m and begging for QSLs. It's to adopt a youngster and exercise your atrophied elmer muscles. We need a serious attack of mentoring.

Don't just sit there limp and jelly-like. Get some fire in your endocrine system. Call the principal of a local school and see if they have a program for people to come in and talk with their students. And if not, why in the hell not? Then go in and talk to the kids about amateur radio. Get 'em excited. And even better, offer to help 'em get their licenses.

We've got something over 400,000 licensed hams who seem to be at least partially alive . . . of which maybe half are even remotely active. I define "active" as being able to find a rig if pressed by a phalanx of steel-eyed, armed FCC inspectors.

It's no wonder we're seeing our ham bands being used more and more by criminals to make their operations easier. What's more secure these days than our ham bands? The Medford (MA) police (none of them hams) used 2m HTs to rob banks and stores. I guarantee we're not using our bands much. Heck, I take my 2m HT along when I travel and call in on every repeater I can find. I'll bet I get an answer on one out of 10. Phooey.

What little activity we have today seems to be concentrated in DX pileups on the low bands, where a couple dozen DXers spend their evenings jamming each other to get a QSL from some exciting place like London or Paris.

Lloyd and Iris are going strong, going from country to country on what seems to be a lifetime DXpedition. The only pity there is that they so seldom write to share their exciting adventures. The next time you work them, see if you can get in a couple words between your call and their signal report to suggest that they should at least take a few minutes a day to write something to help get kids interested in the hobby.

I've DXed from enough rare locations to know that every country visited holds a fascinating story. Did I tell you about my visit to Western Samoa, where I operated 5W1AZ? Did I tell you about how the natives will promptly kill you if you hit one of them with a car? And how they walk in difficult-to-dodge bunches down the middle of the only road on the island at night? Did I tell

Continued on page 68

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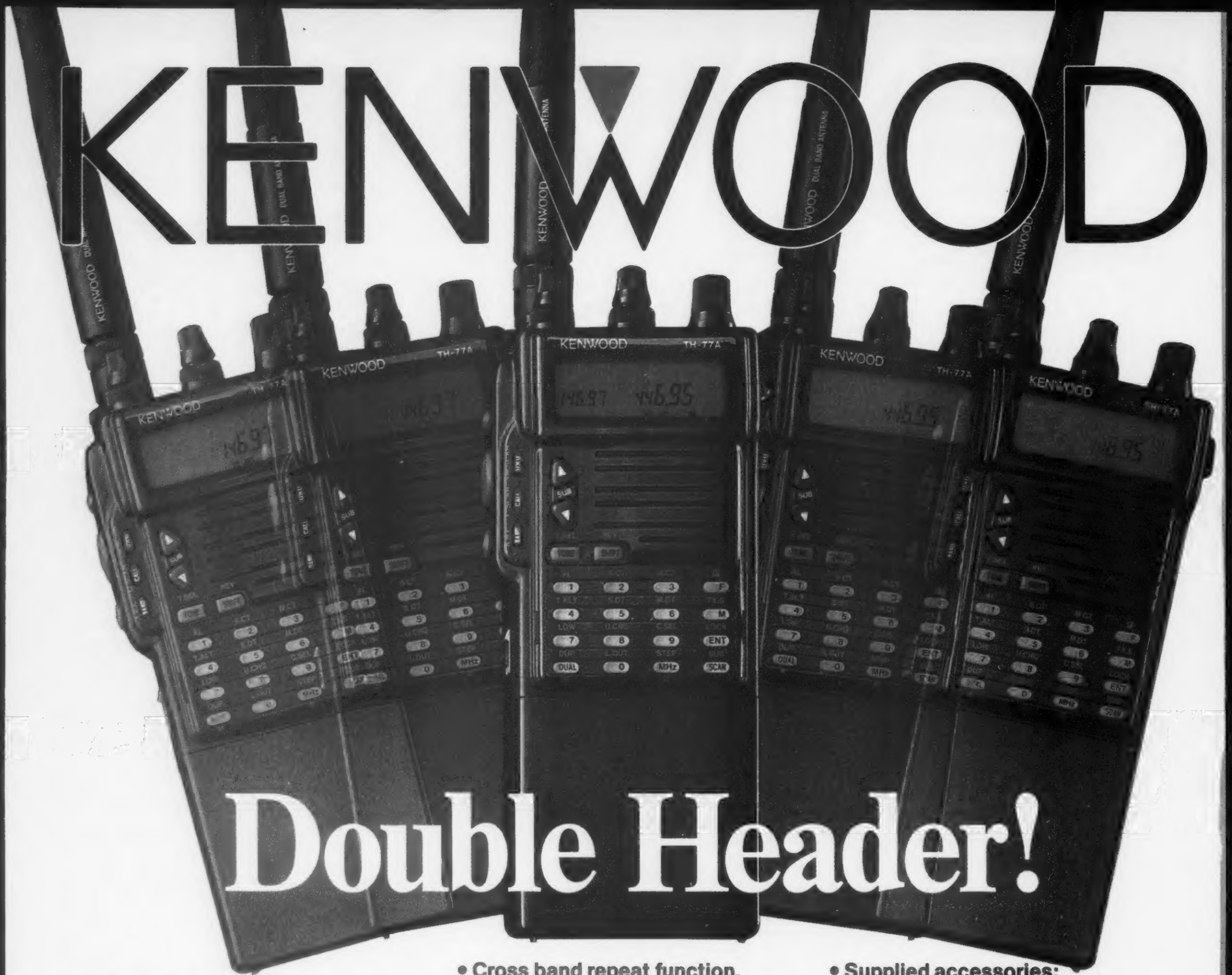

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QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Packet Challenge

On January 25, 1991, the FCC sent violation of Part 97 notices to 11 amateur packet operators, fining several of them $300 for allowing the dissemination of a message allegedly posted by Joseph L. Reed WA3QNS of Norristown, Pennsylvania, on the N3LA/Rolf Jesperson BBS in Spring City, Pennsylvania.

The message publicized a 900 telephone number and urged readers to call the number to register opposition to the war in Iraq. The message did not mention a reported $10 charge for using the 900 number. Amateur operator Russell "TJ" Tjepkema of Virginia Beach, Virginia, believed the message was a business communication outlawed under Section 97.113(a), and reported the matter to the FCC in Norfolk, Virginia.

J. Jerry Freeman, FCC Engineer in Charge of the Norfolk field office, issued the citations "after consulting with many others." Until then, most amateurs believed that only the originator of a prohibited transmission was responsible for message content. Such is not the case, says Freeman: "...the amateur rules provide that the licensee of an amateur station shall be responsible for its proper operation.... Section 310(d) prohibits a radio station licensee from giving his or her license or any of the rights conveyed by the license, to anyone else...." Freeman emphasized that the FCC licenses individual amateur stations, not systems or networks, and that all amateur service rules apply to each amateur station even when it is operating as part of a system.

More than 50 petitions have been filed with the FCC, seeking clarification of responsibility for messages sent through digipeaters, packet bulletin boards, and voice repeaters. As of April 26, four had been formally accepted for commentary.

Packeteers and sysops of BBSs are worried that if every message has to be evaluated before transmission, it will mean the end of packet as we know it. Although Freeman has seemingly backed off a bit by canceling the fines—and in most cases dismissing the charges against BBS operators who have taken corrective action—some angry packeteers are seeking to oust Freeman from government employment.

Freeman W4JJ, an Extra Class amateur himself, says, "Amateur radio operators are very resourceful. As I said before, they may not abdicate their responsibilities, and I believe they will come up with a system which will be able to prohibit dissemination of unauthorized traffic." When asked about the negative effect having to manually evaluate each message for content would have on the amateur's ability to handle traffic, Freeman replied that, "An amateur who retransmits a business or prohibited message is violating the rules. If there is an emergency, their procedures could be changed...they could have various degrees of readiness." TNX *W5YI Report, Vol. 13, #9,* and *Westlink Report, Nos. 600* and *601.*

It's Official

Amateurs must be off 220-222 MHz by midnight, UTC on August 28. That's 8 p.m. Eastern Daylight Time on August 27. The FCC issued its final Report and Order in PR Docket 89-552 on April 29. At that time, it also adopted rules for the use of 220-222 by the Private Land Mobile Service.

Basically, the FCC has divided the 2 MHz slice of spectrum into 400 five kHz-wide slots to create 200 narrowband channels. Ten of these will be reserved for government use. UPS will be the main beneficiary of the new channels.

The Eastern VHF/UHF Society is having a "transition night QSO party," henceforth to be known as "The 220 QSY QSO Party" to mark this "ending and new beginning." It will be in two phases, two hours before and four hours after the change. For complete rules, send an SASE to the Eastern VHF/UHF Society, Thomas J. Kirby W1EJ, 1 Meadow Knoll, P.O. Box 455, Pelham, NH 03076. TNX *Westlink Report, No. 601, B-N-T Bulletin, Vol. 19 Issue 5,* and the Eastern VHF/UHF Society.

Recognition of PRB-1

The Florida Legislature passed HB-203/SB-598, reaffirming federal guidelines in PRB-1. Passage of this bill, which became law on April 28, makes Florida the first state in the nation to recognize PRB-1, the FCC's Private Radio Bureau declaratory "Memorandum Opinion and Order," issued on September 19, 1985. In part, PRB-1 states that "State and local regulation of a station antenna structure must not preclude amateur service communications. Rather, it must reasonably accommodate such communications, and must constitute the minimum practicable regulation to accomplish the state or local authority's legitimate purpose."

Section 166.0453 of the Florida bill covers amateur radio antennas. It forbids local governments to enact unduly restrictive antenna ordinances that do not conform to the limited pre-emption titled "Amateur Radio Pre-emption, 101 FCC 2d 952 (1985)," also known as PRB-1.

ARRL Northern Florida Section Manager Rudy Hubbard WA4PUP originated the idea of pushing for a state law recognizing PRB-1. ARRL State Government Liaison John Hills KC4N of Tallahassee pursued Rudy's idea of asking Hurly Rudd, a neighbor and legislator, to introduce HB-203 in the 1991 session. Many Florida hams wrote, phoned, or telegrammed their district representatives, while Southern Florida ARRL Section Manager Dick Hill WA4PFK and staff pushed hard, too.

Adding to the fervor was a prosecution in Orlando of a ham who violated a blanket 25-foot tower limit under a theretofore ignored Orange County ordinance passed in 1979. According to Rudy, officials held further action in abeyance pending the outcome of HB-203/SB-598.

While future antenna restrictions are not totally banned, local politicians will be slower to think of them in the future. The legislation does not affect private contracts, such as land covenants and deed restrictions. Home and land buyers should research such restrictions before closing on a sale. TNX *Balanced Modulator, Vol. XXVI, No. 5.* TNX also Jim McMillan for sending us an early article on the proceedings. Referenced also was the ARRL's *FCC Rule Book*.

Bigger and Better

The best guess is that well over 35,000 people attended the 1991 Dayton Hamvention. The official attendance was 32,716, which didn't include several thousand youngsters who were admitted free to introduce them to amateur radio. That this 40th edition was bigger and better than ever—12% larger than last year—is a good indication that amateur radio is indeed alive and thriving.

More than $110,000 in prizes was donated by the amateur industry and awarded to lucky ticket stub holders. There was a separate prize drawing for the young people who were admitted free. One conventioneer won an ICOM IC-2SAT in an unusual way: He turned in $1,700 that he found in a folder with no identification. Earlier, however, the money had been reported as lost. Though it wasn't ICOM who lost the money, the firm wished to applaud WA8OKA for his honesty.

The first Hamvention took place in 1951 at the Dayton Biltmore Hotel. Six hundred people showed up to inspect the wares of seven exhibitors and to attend six forums. This is a far cry from 1991's three hundred plus exhibitors and 51 forums on diverse subjects.

In 1964 the Hamvention moved to Hara Arena, where it has been held ever since. New this year were large tent-booths for flea market dealers who couldn't obtain a commercial booth inside the center. Even though there were more sellers than ever, it was a sell-out. TNX *W5YI Report, Vol. 13, Issue #10.*

Help Save Our Bands

Write your congressmen in support of H.R. 73, the Amateur Radio Spectrum Protection Act of 1991. Introduced by Congressman Jim Cooper of Tennessee, a member of the House Committee on Energy and Commerce, this amendment to the Communications Act of 1934 would help prevent further

QRX . . .

Photo A. One of the most frequently heard voices in the Milwaukee, Wisconsin, area is that of Theodore Maddox WA9QQJ, recipient of a Good Guy Citation for his work with Novices. You may have heard him handling traffic when he was active with Navy MARS, too, call N0HEL. After the Navy, Ted joined a CBer's club in order to teach ham radio to CBers, which he did with great success. We salute Ted for his contribution to ham radio.

loss of our amateur radio spectrum. (See the March "QRX" for more details if you wish.) Tell your Congressmen that Jim Cooper has authored H.R. 73 to prevent further erosion of frequencies allocated to the Amateur Radio Service. You might mention that there are nearly half a million hams nationwide. Include the number of hams in your county or state, since this means potential votes. TNX Art Smith W6INI and *Counterpoise, Vol. XXXIII, No. 5.* Excerpt from article.

News from *Mir*

To help expand manned amateur radio in space activities, ICOM and PacComm recently donated gear to the Soviet space station *Mir.* According to Soviet amateur radio space operations coordinator Boris Stepanov UW3AX, the ICOM IC-228 2 meter FM transceiver and the PacComm "Handi Packet" TNC unit are already in orbit.

British astronaut Helen Sharman is presently being briefed by UW3AX on *Mir* amateur equipment operation. At the date of this writing (May 16) she was expected to launch around May 18 and rendevous with *Mir* a couple of days later. Operating from *Mir,* she was to use the callsign GB1MIR/U. If all went as planned, by now Helen would have contacted nominated schools in the United Kingdom, giving the results of and observations on various experiments being conducted aboard *Mir.* Undoubtedly there will be future opportunities to listen in on the 144 MHz contacts. TNX *Westlink Report, Nos. 600* and *601;* and John A. Magliacane KD2BD, CompuServe Space News.

Tiny Cameras

The size of a thumbnail? According to an article in the April 25, 1991 *Wall Street Journal,* researchers at Edinburgh University in Scotland have developed a single computer chip that incorporates all the circuitry needed for a video camera. It does both light sensing and signal processing. Even with the lens that fits on top of the chip, it is still only the size of a thumbnail. When they become available, they may cost as little as $40 each.

While the researchers only envision its use in automatic teller machines for security, other people see more exciting possibilities, such as baby monitors, picture telephones, bar code readers, robotic vision systems, rocketeering, ballooning, and yes—you guessed it—ham amateur television, or ATV. *TNX Miles Abernathy N5KOB.*

Calling Ham Scouts

If you've combined amateur radio with Boy Scout/Explorer activities, Hal Camlin W3QLP would like to hear from you. With the help of the Baltimore Area Council of Boy Scouts, he is writing a book, the *Scouting and Exploring Ham Radio Manual.* Write Hal Camlin W3QLP at BSA Post 73, 7506 Jacquill Road, Glen Burnie MD 21061-3812. TNX *W5YI Report*, Vol. 13, Issue #10.

Writers Wanted

Radio hobbyists who like to write, and writers who are radio hobbyists, are being sought by Tiare Publications. Tiare is interested in developing new titles in all areas of amateur radio. If interested, ask for a copy of the Tiare "want list" which is available for an SASE. TNX Tiare Publications, P.O. Box 493, Lake Geneva WI 53147.

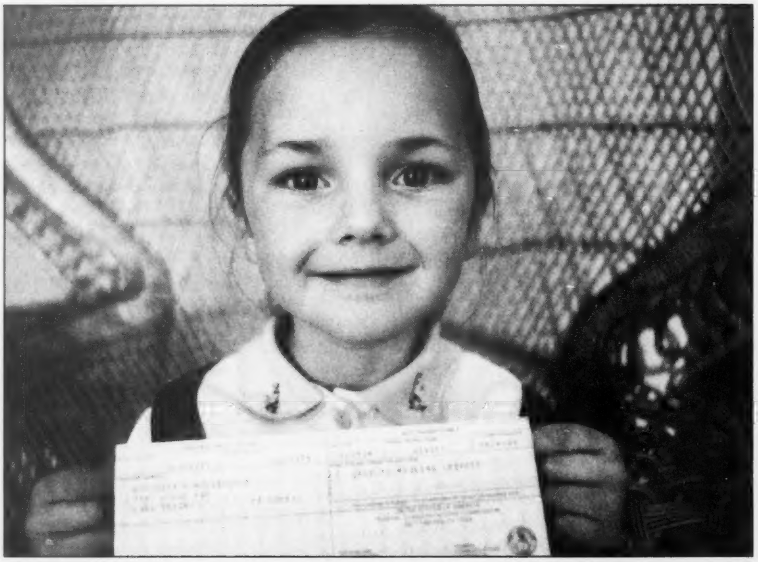

Photo B. Five-year-old Veronica Harrington KC6TQR of Long Beach, California, passed her Novice exam last April. Currently, she's studying for her Technician upgrade so she can get on the local 2 meter kid's net. Veronica also enjoys 10 meter voice. Her mom, Ann N6YGP, and dad, Curt N5HMR, helped her learn code and theory. Her other interests are ghost stories and vintage horror films.

Number 4 on your Feedback card

Micro ATV Transmitter

Can the Dick Tracy video wristwatch be far away?

by Mike Henkoski KC6CCC

Ever think about going pedestrian mobile with ATV from your shirt pocket? If so, here's a project that will enable you to do just that! Thanks to the availability of a new packaged oscillator produced by RF Monolithics, Inc., of Dallas, Texas, the dream has now become a reality.

Most non-synthesized methods of transmitter design for VHF and above require the use of frequency multiplier stages in conjunction with standard crystals. Physical limitations placed on the crystal are such that fundamental frequencies over 20 MHz are not practical, due to the fragile nature of the quartz wafer.

There is, however, another way of gaining higher oscillation frequency using the same quartz material: Use a SAW (Surface Acoustic Wave) resonator. A SAW resonator is formed by placing a pattern of metal reflectors on the surface of a quartz substrate. Using this method, oscillation will occur at much higher frequencies than by conventional means, and you'll be able to achieve fundamental frequencies of more than 1 GHz. This resonator, when combined with microchip technology, will provide a packaged oscillator capable of producing over 5 milliwatts of continuous output in the UHF 70cm ATV band.

Normally, the cost to engineer and produce this type of device would be prohibitive to the amateur radio community. However, as luck would have it, the ATV segment of our band in Germany is used for license-free devices such as car alarms, garage door openers, etc. In looking through the spec sheet from RFM, I noticed that one of the frequencies they produced for the European market was nearly right on top of the 434.00 MHz ATV frequency (see Photo B).

Because of the frequency involved, and the small size of the components used, this project may prove difficult for beginners. Use of SMD (Surface Mount Devices) helps to lessen the effects of stray inductance and capacitance, but the small overall size of the project may still be a real challenge. Some standard components were used in noncritical areas. The primary goal was to end up with a stable and reproducible design.

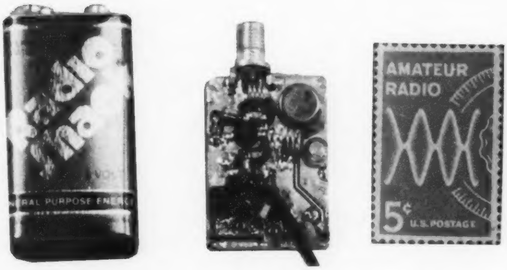

Photo A. The assembled micro TV transmitter.

A Few Tips About SMDs

You have to be able to see it to work with it—use of a magnifier of some sort may be helpful. Sharp tweezers are a must.

Use a small pencil-tip soldering iron with about a 35 watt rating. Make sure the tip is kept clean, and don't linger on the components too long.

When installing a component, tin the pad area lightly, position the component, then tack one side into place. Check the position, then solder the other side. Apply gentle downward force to the component to maintain position. *[Ed. Note: Before you tackle the micro ATV board, you may want to get a bag of SMD resistors from Radio Shack and try your hand at soldering a few practice components on a scrap piece of PC board.]*

Take your time. Fortunately, the parts count is not very high—I assembled the first unit in about two hours.

If you wish to etch your own board, remember that feedthrough positions are not all reflected on both halves; some are on one side, the remainder are on the other. Drill all the holes indicated on both sides independently.

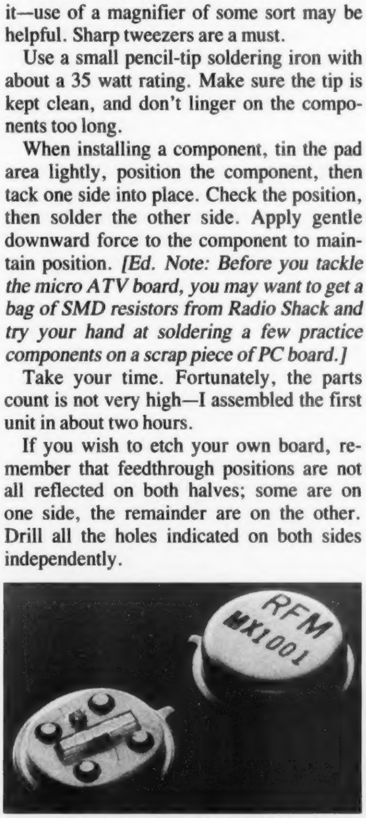

Photo B. The RF Monolithics SAW oscillator module. (Photo courtesy of RFM.)

The winding and placing of the coils require special attention. The closer the coils are made to the dimensions indicated, the easier the tune-up will be.

What Does What

The heart of the micro ATV transmitter is the Micro Transmitter Module by RFM. It consists of a SAW resonator, along with associated circuitry—all contained within a 5-lead TO-39 package.

The device has a maximum rating for the supply of no more than 10 volts, and a power output rated at +7 dBm, or 6 mW. *[Ed. Note: The micro-TV transmitter is designed to operate from a 9 volt battery (7-10 volt operating range). If you plan to use a power supply greater than 10 volts, you must use a voltage regulator IC to drop the voltage below 10 volts.]*

Pin 2 is provided for external modulation input, but for this project it is unusable because the maximum modulation rate allowable is 50 kHz. This pin is tied high through R1 and bypassed by C1. Pin 3 is available for power output adjustment. The value of R2 is set at 33k to allow maximum output power. Pin 4 is VCC with Pin 1, connected to the junction of L1 and C2, providing output tuning. C3 and C4 provide for proper RF bypassing of U1.

The output at L1 is coupled to the secondary L2 which feeds the base and bias network. C3 provides impedance matching to the base of the amplifier/modulator Q1.

Output to the antenna from Q1 is provided by way of matching network L3 and C4. L4, C5, C6 constitute a low-pass network ensuring adequate suppression of the 2nd harmonic (35 dB down). R5 lowers the Q of L3, which provides for greater stability of Q1 for changes in VSWR at the antenna. R5 also serves, together with C7, to block RF from entering the modulator. C10 through C13 provide additional bypassing of the power supply.

The modulator consists of R6 used to match R7 video gain control to the incoming video impedance of 75 ohms. If a 100 ohm value for R7 was available, R6 would not have been necessary, but it's difficult to find chip pots less than 500 ohms. C7 provides DC isolation and impedance matching to the base of video amplifier Q2 and pedestal clamp D1. Vari-

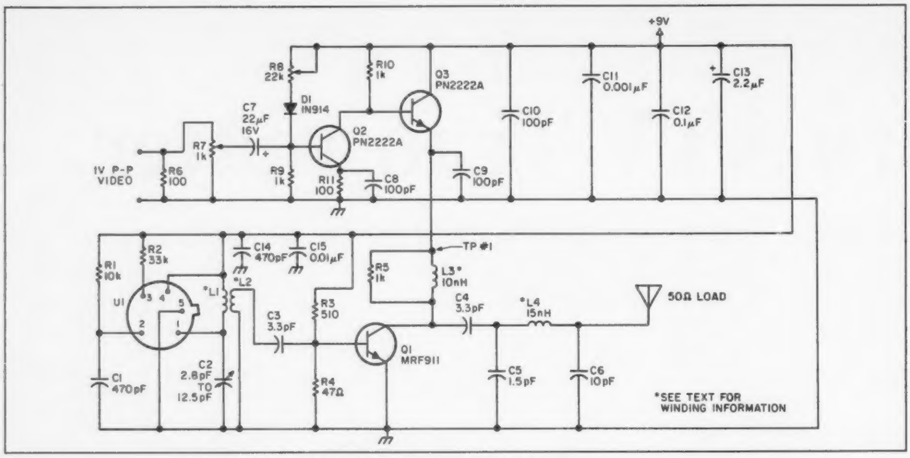
+9V
R8 22k
R10 1k
Q3 PN2222A
C11 0.001µF
C13 2.2µF
D1 1N914
C7 22µF 16V
C10 100pF
C12 0.1µF
Q2 PN2222A
R7 1k
1V P-P VIDEO
R6 100
R9 1k
R11 100
C8 100pF
C9 100pF
R1 10k
R2 33k
C14 470pF
C15 0.01µF
TP #1
U1
*L1
*L2
R5 1k
L3* 10nH
C4 3.3pF
*L4 15nH
50Ω LOAD
C3 3.3pF
R3 510
Q1 MRF911
C1 470pF
C2 2.8pF TO 12.5pF
R4 47Ω
C5 1.5pF
C6 10pF
*SEE TEXT FOR WINDING INFORMATION

Figure 1. Schematic diagram of the micro TV transmitter.

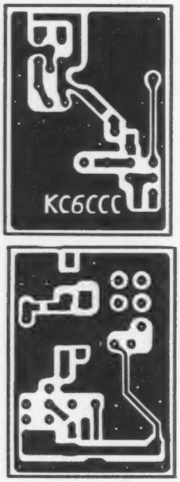

Figure 2. PC board foil patterns. (a). Bottom layer. (b). Top layer. Use a #74 size drill bit for all holes. Be sure to solder jumpers between the top and bottom layers where indicated for efficient grounding.

able resistor R8 sets the proper pedestal clamping and restores the DC level. Without clamping and DC restoration of the video waveform the sync pulse amplitude tends to change with variations of scene illumination. This has the undesirable effect of loss of sync and tearing of the picture.

Resistors R9, R10 and R11 provide proper bias and gain set for Q2. Capacitor C8 serves to boost the high frequency response of Q2 to allow for good resolution and color saturation. Transistor Q3 serves as an emitter follower modulator stage.

Transistor Q1 is run at only 25% of its maximum to ensure low intermod products and also to avoid compression of the horizontal sync. Heat-sinking is accomplished by contact with the PC board clad.

Coil Winding

Coil winding is simplified by using machine screws of the proper size and thread as forms. The wire used may be either insulated or not. I used 24 guage bare tinned wire (available from Radio Shack) on mine because you don't have to strip the coating. Wind each coil tightly on the form and bend the leads to shape while it's still on the form (to avoid distorting them).

Assembly

Install all SMD chip components first, caps and resistors. Then install transistor Q1, making sure to pre-trim the leads first. Leads only need to be about 1/16″ long. The collector is the longer of the leads. When trimming to size, cut the collector at a slight angle to differentiate it from the others.

After prefitting the transistor onto the board, place a small amount of heatsink compound underneath. All that is needed is a 1/32″ dot—too much may make soldering the leads more difficult than necessary.

Next, install all the coils, starting with L1. Solder L2 onto the ground plane on one side, then C3 at the other. The final position of L2 should be such that L1 and L2 appear to be one continuous coil as viewed from directly above. If the two are too far apart, there may not be enough coupling between them.

Install Diode D1, then transistor Q2. Now all the remaining components can be installed. Solder the battery clip leads to the board, observing the proper polarity. Use mini coax to connect the output to the antenna dummy resistor. Also use coax to connect to the video-in on the board. Connect the other side to the female RCA.

Tune-Up

Now we are ready for the final test and tuning, but before continuing use an ohmmeter to check the resistance of the circuit through the battery clip. It should be no less than 400 ohms. If it is, *stop now* and check for shorts.

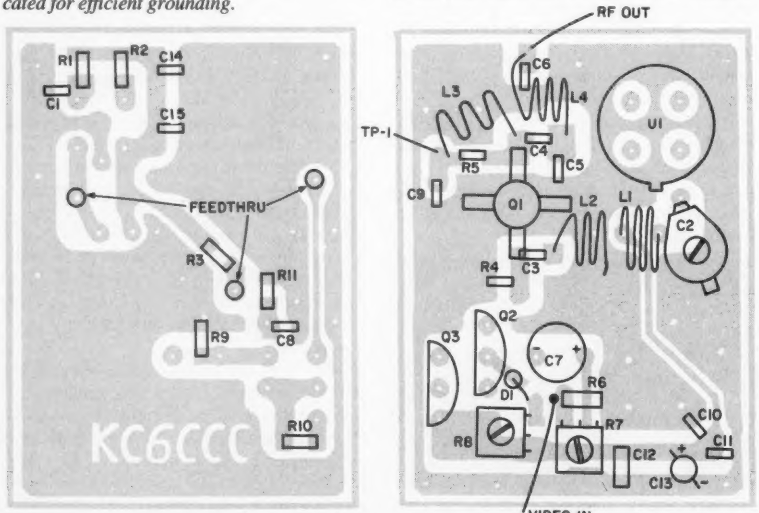
R1
R2
C14
C1
C15
FEEDTHRU
R3
R11
R9
C8
KC6CCC
R10
RF OUT
C6
L3
L4
TP-1
C4
R5
C5
U1
C9
Q1
L2
L1
C2
R4
C3
Q2
Q3
C7
R6
D1
C10
R8
R7
C11
C12
C13
VIDEO IN

Figure 3. Parts placement: (a) Bottom side. (b) Top side.

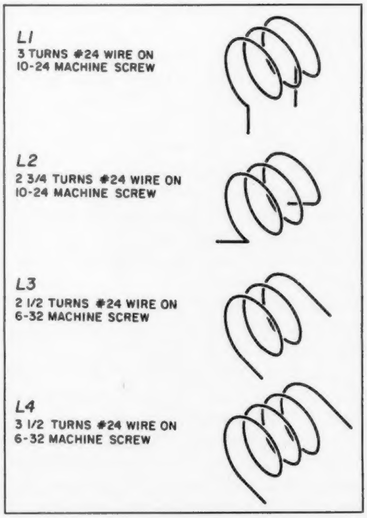
L1
3 TURNS #24 WIRE ON 10-24 MACHINE SCREW
L2
2 3/4 TURNS #24 WIRE ON 10-24 MACHINE SCREW
L3
2 1/2 TURNS #24 WIRE ON 6-32 MACHINE SCREW
L4
3 1/2 TURNS #24 WIRE ON 6-32 MACHINE SCREW

Figure 4. Coil winding details.

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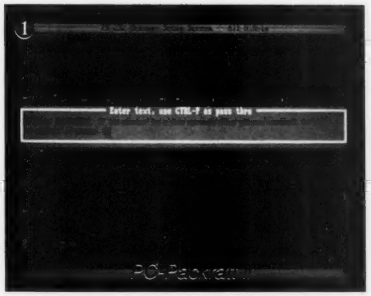
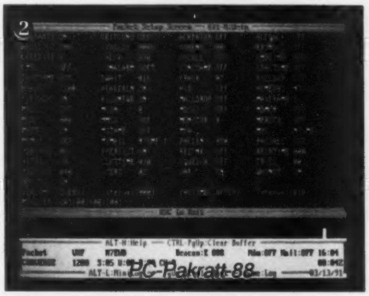
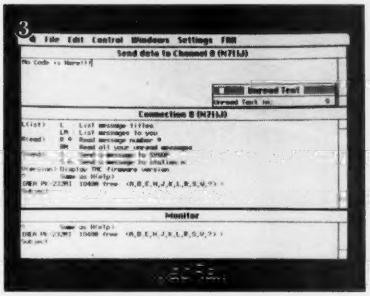
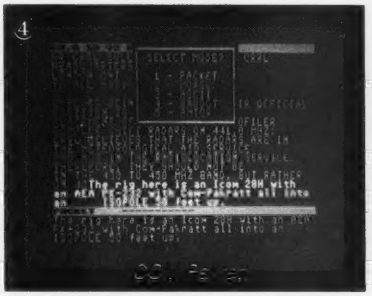
Software Products

Designed with flexibility and performance in mind.

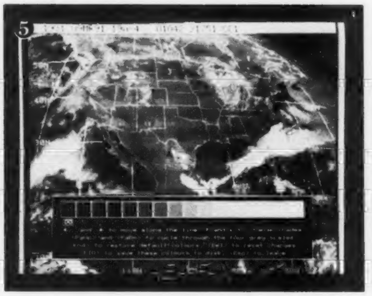








The rig here is an Icom 28H with an AEA PK-232 with Com-Pakratt all into an ISOPOLE 50 feet up.



① **PC-Pakratt II:** *IBM-Compatible terminal control program for the PK-232; menu-driven; works with or without a mouse; full Host Mode support for the latest PK-232 command set; built-in QSO logging facility; fast-initialization cuts start-up time down to a few seconds; disk and printer access for all PK-232 functions including PakMail messages; SIAM™ screen for quick and easy signal identification; DOS gateway; supports COM 1 – 4; includes latest version of the PK-FAX program to display received facsimile images on screen, save to disk and more; can run PK-FAX without leaving the program; command line switches allow you to change baud rate, COM port, mode, etc., easily; complete parameter screens; context-sensitive help* **$69.95**

② **PC-Pakratt-88:** *IBM-Compatible terminal control program for the PK-88; same features as PC-Pakratt II with Packet only and no QSO logging feature; complete host mode support for all PK-88 commands* **$44.95**

③ **MacRATT with FAX:** *Macintosh-compatible terminal control program for the PK-232MBX and PK-88 controllers; includes interface cable for Mac Plus and newer models; windows for entering text, displaying the receive buffer and logging transmitted text; standard Mac features such as scrolling and copying to the clipboard; built-in FAX mode for screen display, save to disk and printing of received WEFAX images; utilizes the Host Mode in the PK-88 and PK-232; can run under MultiFinder for efficient multitasking; complete macro facility* **$59.95**

④ **Com Pakratt with FAX:** *Commodore C-64 and C-128 compatible terminal control program for the PK-88 and PK-232MBX controllers; utilizes AEA's Host Mode; full disk and printer access; split screen operation with separate transmit and receive windows; function key support for most common commands and parameters; includes Com FAX for on-screen fax display and disk/printer access* **$74.95**

⑤ **AEA-FAX:** *IBM-Compatible hardware and software to receive and display facsimile and wire photo images;* ***the right way*** *to do multiple grey levels – not by putting an analog mode into a digital multi-mode controller; 16 grey levels in VGA mode; also supports Hercules monochrome, CGA and EGA; "daisy-chain" RS-232 input so your TNC, modem or other device can be used on the same COM port; "slide-show" mode; tuning scope visible even when receiving an image on screen; auto-save ability; shielded audio cable; 5-1/4" and 3-1/2" disks included* **$99.95**

Specifications subject to change without notice or obligation. Prices listed are suggested Amateur Net through participating dealers. For more information, contact AEA at (206) 775-7373.

Technical support may be obtained through Compuserve's Hamnet forum. Messages should be sent to user ID #76702,1013.

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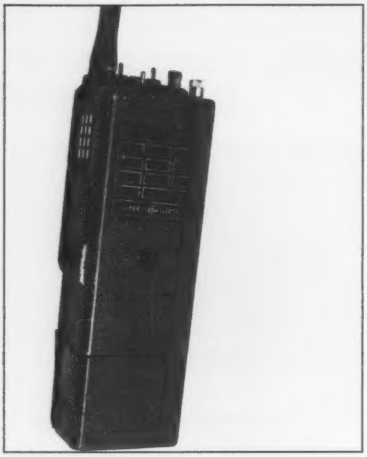

Photo C. Build your own "Lookie-Talkie". The micro ATV transmitter and a GBC CCD-100 or a Micro Video Products micro-TV camera can be easily mounted in an old 2 meter HT case. Note camera lens in center.

Connect a 47 ohm ¼ watt resistor with short leads (dummy load) between the antenna output and ground. Connect a standard 1 volt peak-to-peak video input. Connect an oscilloscope to TP-1, the modulation input to Q1. Apply power to the transmitter. Adjust pots R7 and R8 for 6.5 volts peak-to-peak video at TP-1. What we are trying to do at this point is set the waveform right between the positive rail and ground without compressing either the whites at the bottom or the horizontal sync at the top. The DC level at TP-1 should be approximately 3.3 volts with a 9-volt supply.

Next, adjust C2 to give maximum power output using an RF voltmeter placed across the dummy load. A standard DC voltmeter could be used to adjust the power out by inserting a 1N914 diode between the multimeter and the hot side of the dummy load resistor. Connect the anode of the diode to the load and the cathode to the plus lead of the meter. Adjust for the maximum voltage indication. An alternate method of adjustment would be to use a signal strength meter or wattmeter. Most wattmeters will give some sort of usable indication for peaking.

Remove the dummy load resistor and connect the transmitter to a 70cm antenna—I use an HT rubber duck from my handheld—and observe the picture. You may wish to make some minor adjustments to R7 and R8 at this point.

The peak power output (as indicated on a spectrum analyzer) has been between 80 and 100 mW at the horizontal sync tip. Remember, power meters don't indicate in the same manner, so power output as measured using a meter may be somewhat less. If you have a spectrum analyzer available, you can fine tune by expanding or compressing the coils. Be careful not to short the windings.

Note: Some parts of the country use 434.00 MHz as a repeater input. Please check with the ARRL repeater directory to see if there are any ATV repeaters that may be affected by your transmissions when operating ATV from R/C aircraft. Most ATVers use a 2 meter simplex frequency for coordination of activity. Some of the more common frequencies are: 144.34 (Midwest), 145.17 (Phoenix), 146.43 (West Coast) and 147.45 MHz (parts of Ohio). Check the local activity before you transmit so as not to interfere with other ATV transmissions. Also, other local ATVers will enjoy flying along with your R/C plane if you alert them. Test flights have shown that interference to even weak stations can be minimized by maintaining a distance of at least 15 miles from an ATV repeater.

There are many uses for the micro ATV transmitter. My favorite happens to be flying it in model aircraft. I have also taken one of these transmitters aloft using a kite, and I've even attached one to a model RC car. There have been numerous balloon launches using ATV as a payload. This micro package, used to drive an SAU4 brick-type power amp (such as a PC Electronics PA-5), would make a nice payload. You could also build your own "Lookie-Talkie". Mike WA6SVT put one in a 2 meter HT case along with a micro TV camera (see the Parts List for camera sources) and had a blast carrying it all over the Dayton hamfest (see Photo C). Bring along a pocket LCD TV and you now have instant 2-way video communications in a very compact and portable package. Have fun.

Contact Mike Henkoski KC6CCC at PO Box 3464, San Clemente CA 92672.

Parts List

Part	Description	
All resistors are surface mount type, ⅛ watt, 5%.		
R4	47Ω	Radio Shack 271-313
R6,R11	100Ω	Radio Shack 271-313
R3	510Ω	Mouser 260-511
R5,R9,R10	1kΩ	Radio Shack 271-313
R1	10kΩ	
R2	33kΩ	
R7	1kΩ surface mount pot.	Mouser 321-3100-1K
R8	22kΩ surface mount pot.	Mouser 321-3100-22K
L1–L4		See text for winding info
All capacitors are surface mount type NPO, 50 V unless otherwise specified.		
C5	1.5 pF	Mouser 140-CC501N1.5C
C3,C4	3.3 pF	Mouser 140-CC501N3.3C
C6	10 pF	Mouser 140-CC501N100D
C8,C9,C10	100 pF	Mouser 140-CC501N101J
C1,C14	470 pF	Mouser 140-CC501N471K
C11	0.001 µF	Mouser 140-CC501B102K
C15	0.01 µF	Mouser 140-CC501B103K
C12	0.1 µF	Mouser 140-CC502B104K
C2	2.8-12.5 pF trimmer	Mouser 24AA071
C13	2.2 µF, 16V tantalum	Radio Shack 272-1435
C7	22 µF, 16V tantalum	Radio Shack 272-1437
D1	1N914 diode	Radio Shack 276-1122
Q2,Q3	PN2222A NPN transistors	Mouser 592-PN2222A
Q1	MRF911 NPN transistor	RF Parts, Inc. or ECG63
U1	MX1020	SAW oscillator (RFM)
Misc. parts:		
2'	#24 solid wire	Radio Shack
1	9V battery clip	Radio Shack 270-325
	Mini coax RG-174 type 50Ω	Belden
1	Female RCA phono plug	
1	Female SMA connector (optional)	E.F. Johnson 142-0701-201 or equiv.

Kits or Assembled/Tested:

A complete kit including SAW oscillator, blank PC board and all components is available for $89 ppd. from Elktronics, 12536 TR 77, Findlay OH 45840. (419) 422–8206. Also available as separate items are the blank PC board ($19) and the 434 MHz SAW oscillator ($30).

Assembled and tested micro ATV transmitter boards (catalog #ATVM-70) are available for $119 from PC Electronics, 2522 Paxson Lane, Arcadia CA 91007. (818) 447–4565.

Please include your callsign with your order.

TV camera sources:
GBC CCD-100 miniature TV camera
CCTV Corp., 315 Hudson St., New York NY 10013, (800) 221–2240.
Micro-Video Camera
Micro Video Products, 1334 Shawnee Dr., Santa Ana CA 92704.
(800) 473–0538 or (714) 957–9268.
Parts sources:
Mouser Electronics; (800) 346–6873.
RF Monolithics, 4441 Sigma Rd., Dallas TX 75244. (214) 233–2903.
RF Parts, 1320 Grand Avenue, San Marcos CA 92069. (619) 744–0700.

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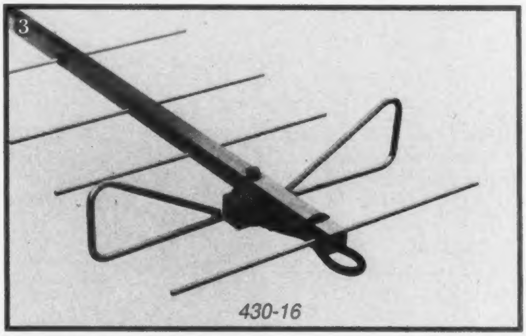
Amateur Television Products

❶

VSB-70

3



430-16

❷

LA-70 w/MPS-100

4

① ***NEW!*** **VSB-70 ATV Transceiver:** *the only amateur television transceiver utilizing VSB (Vestigial Sideband) technology to minimize adjacent channel interference and preserve spectrum space; built-in UHF GaAsFET preamp to improve reception; covers the 70 cm band, 420 - 440 MHz; inter-modulation distortion less than -42 dBc; one watt PEP output; monitor transmitted and received signals on your standard TV receiver; audio and video input via front panel 10-pin camera jack or rear panel RCA audio and video inputs (switchable); crystal-controlled or variable-tuning down converter; crystals for 434 and 439.25 MHz are included; optional crystals for 421.25 and 426.25 are available; requires 13.6 VDC @ 1.5 amps* **$349.95**

② ***NEW!*** **RLA-70 Remote Linear Ampifier with Power Supply:** *mast-mounted amplifer boosts your ATV signal up to 50 watts PEP; equivalent to a 100 watt amplifier in the ham shack with a 3 dB line loss; built-in GaAsFET preamp mounted at the antenna where it does the most good; power supplied through the coax; includes* MPS-100 Multi-purpose Power Supply: *provides a well-regulated 28V DC @ 6 amps for the RLA-70; also provides regulated 13.6V DC @ 2 amps for the VSB-70* **$699.00**

③ **430-16 Antenna:** *high-performance, computer optimized yagi specifically designed for ATV operation; broadband frequency coverage from 420 to 440 MHz; 16 elements give you 14.3 dBd gain; O-ring sealed connectors; 28 degree E-plane beam width; 32 degree H-plane beam width; 10 foot boom* **$119.95**

④ **AVT Master Amiga Video Terminal:** *SSTV and FAX system (hardware and software) for transmit and receive with your Commodore Amiga Computer; 55 SSTV modes in up to 4,096 simultaneous colors; Nine FAX modes in up to 16 grey levels; eight function "repair kit" vastly reduces damage caused by QRM or QRN; on-screen tuning scope; mode-to-mode conversions; interpolating zoom; image tinting, brightness and contrast control; text overlay using multiple fonts, boldface, italics and underlining in any combination or color; automatic CW and/or synthesized speech ID after transmit; custom color bar generation; user-defined FAX demodulation curves; image rotation and flipping; paint compatible; extensive ARexx language support; real-time software filtering for scope and receive operations; grab screens to transmit from any digitizer or operating program in real-time; automatic start and run at any time; image printing in both black-and-white and color on hundreds of printers* **$299.95**

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Number 5 on your Feedback card

Tropo Time is Now!

Talk thousands of miles on the VHF/UHF bands.

by Gordon West WB6NOA

Hooking up with a repeater 300 miles away, direct, on FM, is often possible during the summer and fall months. If you own a VHF or UHF mobile or base unit with SSB capabilities, your long-range contacts on what are normally short-range frequencies can really get exciting. And if conditions are just right, you can access an FM repeater over a thousand miles away! Imagine that.

The phenomenon for long-range VHF/UHF and microwave DXing is called tropospheric ducting. But don't confuse "tropo" with E-layer skip (Es), which may only last for a few minutes on 2 meters. The latter is the result of ionospheric reflections from high altitude, densely ionized clouds caused by wind shears. Tropospheric ducting, created by temperature inversions, may last for days and sometimes even weeks.

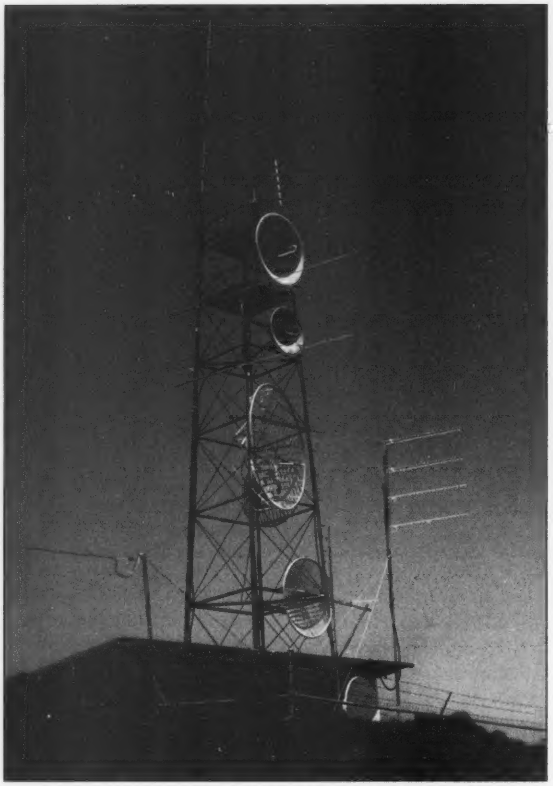

Photo A. The KH6HME beacon site at the 8200' level of Mauna Loa volcano, on the big island of Hawaii.

Super Mirages

Picture the tropospheric duct as an inverted mirage that occurs in the atmosphere above us. You've all seen a mirage, where you look DOWN the road and see the shimmering blue sky refracted from ABOVE by the sharp boundary layer of hot air lying inches above the ground. In a tropospheric duct, a sharp boundary of hot air associated with a high pressure system sits above us, causing VHF and UHF signals to refract along the bottom side of this layer, which might hug the horizon for over 2,000 miles!

In rare instances recorded in Santa Barbara, California, and Key West, Florida, the tropospheric duct became so extensive that observers reported seeing distant land masses appearing upside down, shimmering, out at the horizon! This optical super-refraction is the same atmospheric phenomenon that lets you see the glow of the big city lights hundreds of miles away, and also lets you receive TV channels from three states away! This usually happens in summer and fall.

The VHF and microwave radio horizon is generally 4/3 the visual horizon. The slight bending, or refraction, of straight-line VHF/UHF and microwave frequencies is similar to the bending effect you see when you put a rod in a glass of water. The refractive index of water is different from the refractive index of air, however.

Under normal weather conditions, the radio refractive index of air, represented by the symbol "N" for "Normal," is slightly over 1 (more specifically, 1.000345 to 1.000300). Pressure decreases with height in a logarithmic manner at about 1 mb for every 10 m in altitude. Temperature decreases 20 degrees Fahrenheit for every mile of increasing altitude in the troposphere up to approximately 40,000 feet. Along with pressure and temperature dropping as altitude increases, water vapor content also drops. (This is what is meant by "normal weather conditions.") The air is very dry when you are up there in a jet, flying across the U.S.

Decreases in temperature and water vapor are what most affect extra long-range VHF/UHF and microwave DX. When the weatherman talks about a high pressure system settling in for a few days with an expected temperature inversion, get ready for the possibility of a major "bump" in the normally smooth refractive index. At about the thousand-foot level, the inversion causes the temperature to quickly increase instead of decrease, as would be normal; and water vapor content abruptly drops; the air gets dry as a bone inside this thin inversion layer.

An inversion layer strong enough to create a big DX tropo duct develops as part of a stationary high pressure system. The high pressure "cell" is characterized by air descending toward the surface of the earth. As the air begins to drop, it gets warm. They call this "subsidence." At about

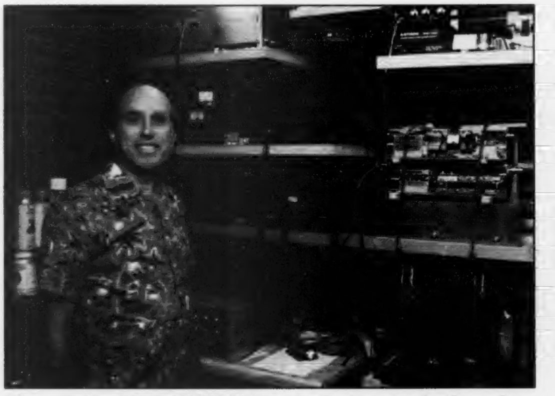

Photo B. Paul Leib KH6HME inside the beacon shack ready to work long-haul VHF and UHF DX back to the mainland.

Communications Specialists TE-64

Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

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- Output level flat to within 1.5db over entire range selected.
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- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

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67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

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- Frequencies to 250 Hz available on special order
- Continuous tone

Group B

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2175	941	1633	1750	2000	2300	2550
2805			1800	2100	2350	

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- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

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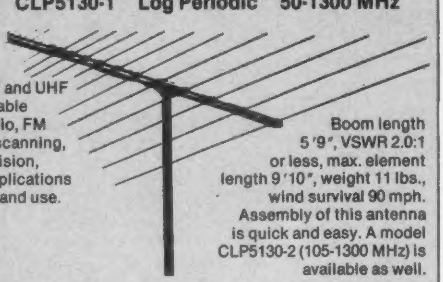

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CR30	9′10″	39″	27 @ 90 mph	1,322	33
CR45	14′9″	39″	23 @ 90 mph	881	57

CK46 Thrust Bearing—Max. Mast Diameter 2½″

CREATE **ROTORS**

Model	Rotation Torque (lbs./inch)	Brake Torque (lbs./inch)	Mast Size
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RC5-3	520	6075	1⅞″ - 2½″
RC5A-2	1388	13,020	1⅞″ - 2½″
RC5A-3	1388	13,020	1⅞″ - 2½″

Model	Vertical Load (lbs.)	Horizontal Load (lbs.)	Preset	Indicator Accuracy	Square Feet	Weight (lbs.) (Rotator Unit)
RC5-1	880	1760	...	±5° Max	10	13
RC5-3	880	1760	Provided	±4° Max	10	13
RC5A-2	1540	2200	...	±4° Max	25	17
RC5A-3	1540	2200	Provided	±4° Max	25	17

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TH-47A	70CM 2-5W MICRO	429.95	359.95
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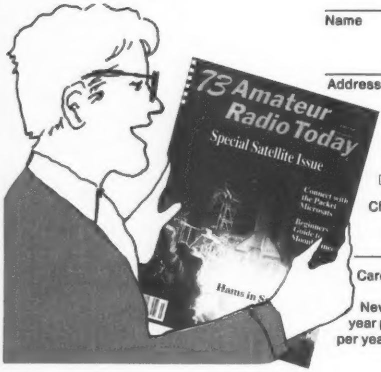
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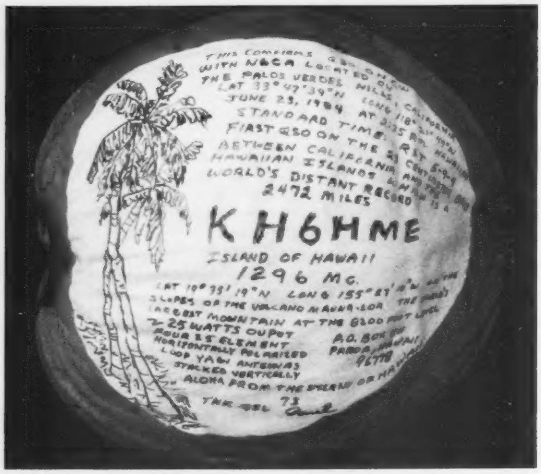

THIS CONFIRMS QSO ON [illegible]
WITH N6CA LOCATED ON
THE PALOS VERDES HILLS, CALIFORNIA
LAT 33° 47' 39"N LONG 118° 21' 49"N
JUNE 23, 1984 AT 2:35 AM HAWAIIAN
STANDARD TIME. RST 5-9-9
FIRST QSO ON THE 23 CENTIMETER BAND
BETWEEN CALIFORNIA AND THE
HAWAIIAN ISLANDS WHICH IS A
WORLD'S DISTANT RECORD
2472 MILES

KH6HME

ISLAND OF HAWAII
1296 MC.

LAT 19° 35' 19"N LONG 155° 27' [illegible] ON THE
SLOPES OF THE VOLCANO MAUNA-LOA THE WORLD'S
LARGEST MOUNTAIN AT THE 8200 FOOT LEVEL
2-25 WATTS OUPUT P.O. BOX [illegible]
FOUR 25 ELEMENT PAHOA, HAWAII
HORIZONTALLY POLARIZED 96778
LOOP YAGI ANTENNAS
STACKED VERTICALLY
ALOHA FROM THE ISLAND OF HAWAII
THX QSL 73
Paul

Photo C. The KH6HME QSL "card" to Chip Angle N6CA confirming the record-breaking 1296 MHz contact of 2472 miles. Photo courtesy of KH6HME.

Continued from page 14

the 1,000 foot level within the high pressure air "fallout," surface winds—especially those cool moist winds associated with large water masses—keep the descending air from bottoming out on the surface of the earth (ocean or land mass). This creates a band of warm dry air associated with the high, "capping," cool moist air below it. If the winds are gentle, this inversion layer may extend for hundreds or sometimes thousands of miles, and VHF and UHF waves are caught up in it. It acts like a waveguide; the radio waves go and keep going, with almost no attenuation.

Bruce Eggers WA9NEW, an expert in the study of super refractivity, says, "In the Northern Hemisphere, there are two very permanent high pressure systems which combine all the parameters contributing to super refractivity and tropospheric ducting . . . the Pacific high to the north and east of Hawaii, and the East Coast of the U.S. where the Gulf Stream brings warm water north along the coast. And in the Southern Hemisphere, there are some interesting potential tropospheric ducts, from the most southern islands in the Pacific (Pitcairn) to Chile and Peru. There is also the path between St. Paul and Perth, over the Indian Ocean."

Experts agree it is relatively warm dry air, associated with a high pressure system over cool, moist air, which can trigger extra long VHF and UHF/microwave ranges. These same conditions may also occur behind cold fronts, and in advance of warm fronts, where propagation will occur at higher frequencies like microwaves, rather than VHF frequencies. This is because the frontal zone is just the right thickness, neither too high nor too low.

The most consistent summertime and fall record-breaking tropospheric duct occurs between California and Hawaii. The discovery of this yearly phenomena was confirmed on July 8, 1957, when John Chambers W6NLZ in California successfully contacted Ralph Thomas KH6UK on 2 meters, repeating the 2,540 mile haul on the 220 MHz band from two years before. Then Louis WB6NMT made the grade on 70 cm in the early '70s. In 1983, Chip Angle N6CA and Paul Lieb KH6HME made a record-breaking contact on the 1296 MHz band. Paul and Chip have set their sights on the microwaves beyond 1296 MHz, and who knows when the California/Hawaii duct may support two-way communications as high as 10 GHz?

But nothing is more important than knowing when the band is open. Even the very best tropospheric duct will be an absolute loser if the gangs in Hawaii and the mainland don't realize the band is open.

The California-Hawaii Duct

In the United States, automatic beacons of 100 watts or less, operating on VHF/UHF and microwave bands, assist in the detection of a long-haul duct. It takes an SSB transceiver to pick up these beacons. The most distant beacons heard are on the 8,200-foot slopes of Hawaii's 13,680-foot Mauna Loa, an active volcano.

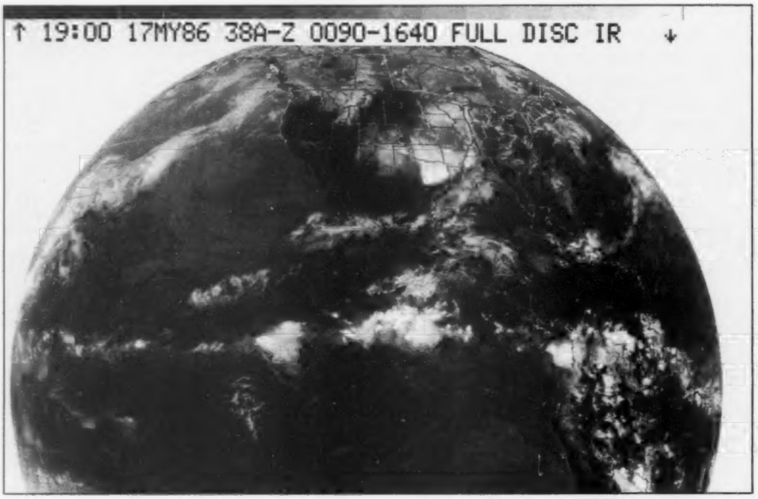

Photo D. A high pressure system sitting between California and Hawaii can be seen as a smooth haze on this satellite photo. A spectacular 1296 MHz opening occurred this day.

All beacons operate simultaneously in the CW mode, identifying KH6HME. The 2 meter beacon signals at 20 wpm, with a rise in the final steady tone by approximately 100 Hz. The 432 and 1296 MHz beacons operate at 13 wpm.

Hawaii ham Paul Lieb KH6HME is the main man at the beacon location. Hawaii television Channel 9 has allowed Paul and his beacons to occupy a metal building that's precariously perched on the side of the Mauna Loa volcano—a volcano that sees red hot lava activity just a few miles south of the beacon location!

Paul is alerted to the reception of the beacon signals by West Coast amateur radio operators. The beacons have been heard as far north as Oregon, and as far south as Mexico.

"When I get the phone call that the beacons are coming in, I pile all of my transceivers into the back of my station wagon, and take the one and a quarter hour drive from Hilo to the Mauna Loa beacon location. And as I go

KH6HME Beacon Characteristics

Beacon Location	19° 35'19" N; 155° 27'10" W
Elevation	8200 feet on the side of Mauna Loa volcano
6 meter beacon	50.061 MHz, 20 watts, 3-element beam, toward the mainland
2 meter beacon	144.170 MHz, 60 watts, into a pair of home-brew 7-element yagi (NBS) horizontal antennas
222 MHz band	No beacon, just two-way
70 cm beacon	432.075 MHz, 35 watts output, into a pair of long-boom horizontal yagis
ATV	434.000 MHz (on command, alternates with the CW beacon), 80 watts peak video output into a pair of K1FO beams.
900 MHz	two-way equipment
23 cm beacon	1296.000 MHz, into a stack of 4 loop yagis
Liaison frequency	28.885 MHz USB, 100 watts into full wave loop

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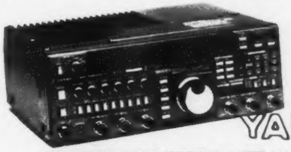

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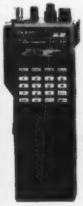
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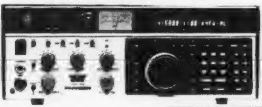

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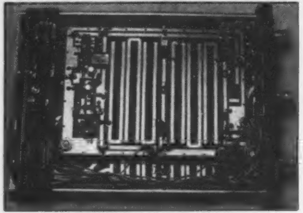

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1691LNAWP	preamp 1 dB NF	1691 MHZ mast mounted	13.8V	$140
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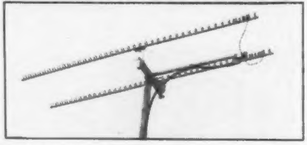

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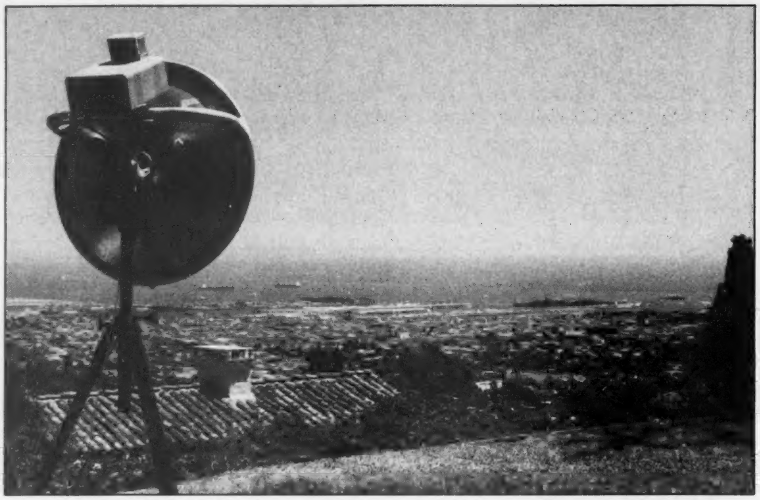

Photo E. Will 10 GHz contacts be possible between California and Hawaii? (Author's setup at Palos Verdes, California, pointed towards Hawaii).

up the mountain, passing through the different tropospheric levels, I can hear the mainland FM music broadcast stations get louder and louder," says Paul. He also gets the word out on the local repeater to Russ KH6FOO, Al KH6IAA, and Jack KH6CC, that tropo time has arrived. These operators give additional contacts to the mainland when the tropospheric duct gets low enough to their home locations.

"When I get to the site of the beacons, I can usually look out on fog and low clouds approximately 500 feet below our 8,200-foot elevation. The air is sometimes quite warm, and this tells me I'm right in the middle of the duct."

A New Challenge for ATVers

This year, Paul is trying a new mode of communications between Hawaii and California: amateur television at 434 MHz. Using PC Electronics' equipment, a Mirage 80 watt repeater amplifier custom-tuned by PC Electronics, and the Elktronics' video ID board, a new type of world record may soon be set for all ATVers to enjoy. FM signal strengths will need to peak well over S-9 in order for an ATV signal quality of P3 to be achieved, but in the past, 60 dB over S-9 narrowband FM signals have easily made the grade. According to Paul, "Sure, it can be done if the tropospheric layer achieves just the right thinness to trap the 434 MHz ATV signals."

If you are not equipped with an SSB transceiver, you can still make some long-range tropospheric duct contacts on FM. Between Texas and Florida, 25 watt FM rigs have sufficed. Just a few years ago, a widespread opening allowed mobiles in Boston to work mobile stations in Florida on 146.520 MHz FM! And most recently, FM hand-held contacts took place between Miami and Cuba—albeit both stations were using handhelds atop tall buildings. Nonetheless, the tropo duct allowed them to exceed FM handie-talkie range well beyond what could ever be expected under the best of conditions.

This summer, keep an eye on your television for signals from an outside antenna system showing up on normally unused channels. If you're on cable television, chances are the only way to detect a long-haul tropo duct is interference lines coming in over the master cable link receive station.

You can hear a tropospheric duct quite easily on your automobile or home FM stereo receiver. Once again, tune to frequencies not normally used in your area, and listen for distant stations. Same thing with your FM 2 meter and 432 transceivers—listen to repeaters coming in on frequencies that are normally absolutely vacant. Try programming repeaters over 200 miles away into your mobile, and wait for a hot, windless day to see whether or not you can pick them up.

Every summer, long-haul tropospheric band openings occur to span distances well over 1,000 miles in the United States, and also between California and Hawaii. Sure, big directional antennas will give you the edge over smaller systems when the band opening is beginning to form, but once the tropo duct gets into full swing, almost any kind of VHF antenna should work the path well.

On FM, stay with vertical polarization. On sideband, most beacons and most DX stations operate horizontal. Cross-polarization within a duct could knock down signals by as much as 9 dB—so keep your antennas in the same plane.

Who knows what will happen with global warming, and with the warm ocean currents now beginning to form in areas that, normally, have been cool? This could be the best year ever for anyone with any type of VHF or UHF transceiver, including a handheld, to enjoy the excitement of long-haul DX tropospheric ducting. ■

You may contact Gordon West WB6NOA at 2414 College Dr., Costa Mesa CA 92626. Please include an SASE if you request information.

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3. Start recording
(and, believe it or not, it's done!)

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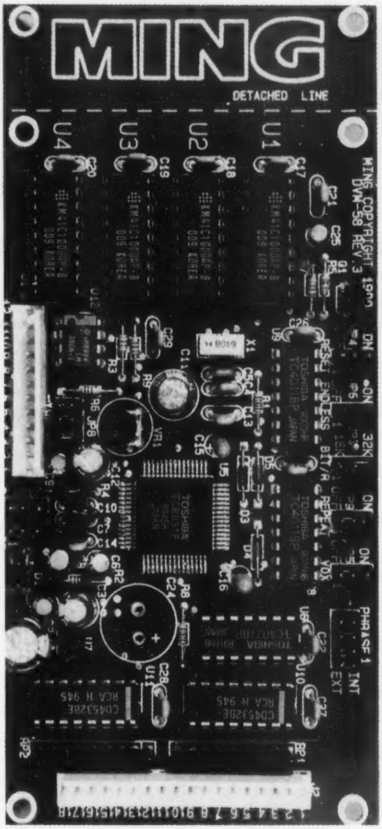

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- "AUTOMATIC RESET" simplifies single message recording operation.
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Antennas by the Yard

HT antennas that really measure up!

by Ruston Cable WA6TLK

I wanted a rugged walkie-talkie antenna that would be tough, and also give me a little better performance than the standard rubber duck. This antenna is it. You can literally tie it in a knot without damage.

The required materials, shown in Photo A, are: an unpainted steel tape measure, binding post to male BNC or UHF adapter (Pomona P/N 3430 for BNC and P/N 1698 for UHF) and, not shown, some ½-inch PVC shrink tubing in the colors of your choice. *[Ed. note: If you can't find these adaptors at your local electronics store, they are available from Newark Electronics (312) 784-5100, P/N 35F1070 or 35F1069. Also Circuit Specialists (800) 528-1417, P/N 3430-0 or 3430-2.]*

3m. 10ft.
LUFKIN

Photo A. Materials required.

Construction

If you haven't figured out what we are going to do yet, it's simple. Open up the housing of the tape measure, using whatever means is required. Inside you will find a nice roll of stainless steel antenna material, already marked off for you in inches, centimeters, feet, etc. Now, using whatever mathematical formula you like, calculate the length of tape needed for a quarter-wave length on the particular band for which you are making the antenna. Remember, these antennas can be made for any frequency: Civil Air Patrol, marine, MARS, scanner or aviation. I am using the amateur 2 meter band version for demonstration purposes. Construction for any other band is exactly the same.

Using a pair of scissors, I cut the length for the antenna to 21 inches. Remember to cut yours longer than calculated because it's a lot easier to cut the extra off than it is to add what you don't have. I then took a household ¼-inch paper punch and punched a hole near one end of the piece of tape (see Photo B). If you don't have an unpainted tape measure, now is the time to remove the paint from around the hole you just punched, using some fine, wet and dry sandpaper. This will insure a good electrical connection with the adapter. Also, trim off the corners on both ends of the tape using the scissors, then sand the ends to remove the sharp edges that are created from the cutting. Trust me, they are there and cut like a razor blade.

Now, the adapter. It doesn't matter if you're using the BNC or UHF adapter, the procedure is the same. First, remove the pretty-colored plastic-covered captive thumb nut. These thumb nuts are not intended to come off of the adapter under normal use, but they will if you use more then average force to unscrew them. If you have a really stuck one, use two pairs of small pliers and unscrew the thumb nut from the binding post.

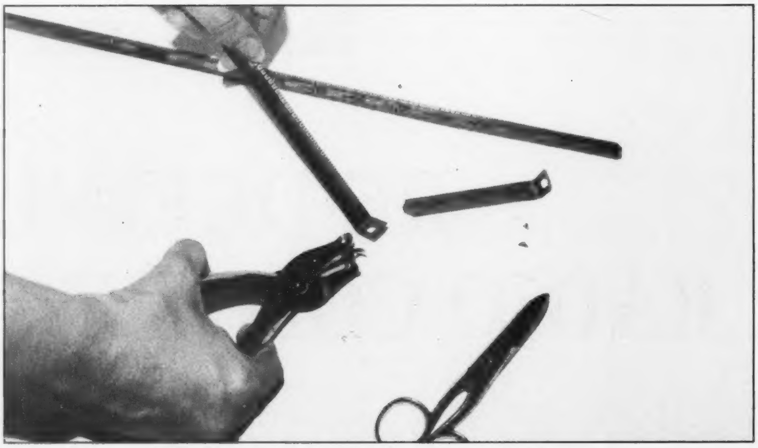

Photo B. Punch a ¼-inch hole near one end of the tape.

You now have the two basic parts for the antenna. Run the binding post screw through the hole in the tape and screw the thumb nut back on as tightly as you can, using the pliers if necessary. Then, bend the steel tape flush up the side of the thumb nut. Put a piece of tape or rubber band around the antenna element and thumb nut to temporarily hold it in place. You now have an antenna ready to be trimmed to the desired frequency.

Tuning and Using the Antennas

To tune the antennas, I used a Bird Model--

FLYWEIGHT BODY with HEAVYWEIGHT FEATURES

Alinco's New DJ-F1/F4T Realized Super Compact Body and Plenty of Features including:

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The DJ-F1T/F4T has special memory channels for transmitting, receiving, and store "Two Digit" DTMF Tones, for communication messages. This feature allows for the DJ-F1T/F4T to receive a "Two Digit" message and display it at any later time, at the convenience of the operator.

***Wide Band Receiving range**
F1T:140-170MHz(AM Mode 118-136MHz after modification)
F4T:430-460MHz

***Battery Pack Lock**
***Pager and Code Squelch**
***Triple Stage Selective Power Output**
***5W Output Power with Optional Battery Pack EBP-18N**
***8 Scan Modes**
***Programmable VFO Range Function**
***Battery Save Function**
***Six Channel Steps - 5, 10, 12.5, 15, 20, and 25KHz**
***Priority Function (Dual Watch)**
***Automatic Power Off** (Programmable Timed)
***Automatic Dialer Function**
***Illuminated DTMF Keypad**
***Many Optional Accessories such as:**
EMS-8:Remote Control Speaker/Mic.
EME-11:Earphone/Mic. with PTT/VOX
EME-10:Headset with PTT/VOX
EJ-2U:Tone squelch Unit
EDC-33:Quick Charger (Compatible with standard battery pack)

and many more. . . . .

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DJ-F1
CALL
V/M
LAMP
SCAN
MONI
PO
VHF FM TRANSCEIVER
SHIFT
OFF SET
REV
DIAL
TONE
SKIP
T.SQ
DSQ SET
CLR
TMS
APO
D CHG
PRI
ALINCO
DJ-S4
CALL
V/M
LAMP
SCAN
MONI
PO
UHF FM TRANSCEIVER

DJ-F1T

DJ-S4T

DJ-S1T/S4T is Simple Type and Low-Priced But Offers Features such as:
* **5W Output Power with Optional Battery Pack EBP-18N**
* **Triple Stage Slective Power Output**
* **Dry Cell Battery Case Lock**
* **Programmable VFO Range Function**
* **Frequency Lock, PTT Lock Function**
* **One Touch Squelch De-Activation Function**
* **8 Scan Modes**
* **Wide Band Receiving Range**

Available Features with Optional DTMF Unit (DJ-10U) and DTMF Keypad (ESK-1) Include:
* **Pager and Code Squelch**
* **Digital Signal Display and Memory Function**
* **Automatic dialer Function**
* **Many Optional Accessories Available**

•Specifications

Frequency Range:
DJ-F1T/S1T
TX:144-148MHz
RX:140-170MHz (AM Mode 118-136MHz after Modification)
DJ-F4T/S4T
TX:440-450MHz
RX:430-460MHz

Output Power:
* with Battery Pack EBP-16N (Standard for F1T/F4T)
Hi:2W(F1T/S1T) 1.5W(F4T/S4T)
Mid:1W Low:0.1W
* with Optional Battery Pack EBP-18N
Hi:5W Mid:1W Low:0.1W
* at 9V
Hi:2.5W(F1T/S1T) 2W(F4T/S4T)
Mid:1W Low:0.1W

Weight:
DJ-F1T/F4T Approx.:13.2 oz.: with Standard Battery Pack
DJ-S1T/S4T Approx.:13 oz.: with Dry Battery case

Dimensions:
4.3(H) × 2.1(W) × 1.5(D) inch
(Without Projections)

Specifications and features are guaranteed for amateur bands only and subject to change without notice.

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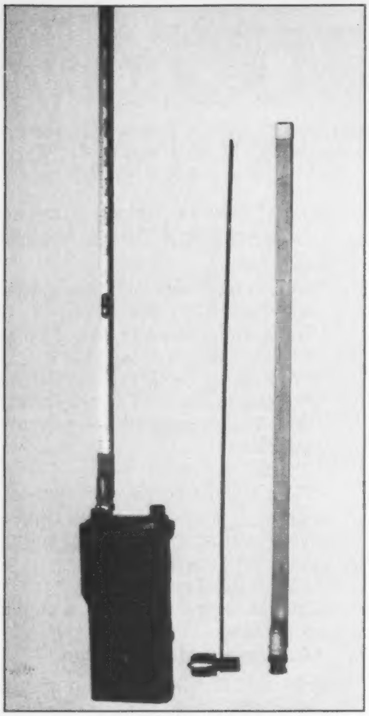


Photo C. *The finished antennas.*

43 thruline wattmeter and an ICOM 2 meter rig installed in the car. Use whatever setup you have to monitor the reflected power, VSWR or field strength. As shown in the picture, the actual trimming was done with my trusty scissors. The first reading on the Bird showed quite a bit of reflected power. And, knowing it was too long, I started cutting off ¼-inch pieces of tape from the top of the antenna until the reflected power started coming down toward zero. I then shaved off small pieces to get zero reflected power in the center of the band. The actual length turned out to be exactly 17 inches.

As a finishing touch, I offer two suggestions. Either cover the entire antenna with the PVC shrink tubing, or add just a small piece, about four inches, over the thumb nut area to hold the antenna element in the vertical position. The one with the small piece of PVC at the nut is a little more flexible, and lighter. It's your choice. It's best to use a heat gun to shrink the tubing over the antenna and connector. You can also use the hot burner of an electric stove as long as you keep in mind the PVC will melt and burn, so keep it from touching the hot element, but near enough to get good shrinking action. On the antenna that I covered completely with PVC, I added an extra piece of tubing over the thumb nut area to give it a little more rigidity and sturdiness in the base area.

That's it. After you make one, it takes about five minutes to make the next one. One option, if you want still more rigidity, is to put two or three antenna elements together and cover them all with the piece of PVC. I used three pieces of steel tape: one the length cut for least reflected power; the others one-third and one-half that length. This gives the antenna a tapered effect, with maximum flexibility toward the top of the antenna. No adverse effect was noted in the reflected power by the added layers of steel tape. The finished antennas are shown in Photo C.

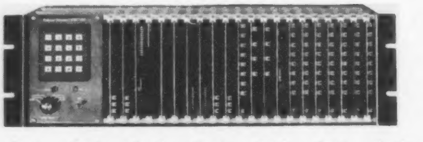
Originally, I used these antennas to replace the rubber duck antennas on walkie-talkies and other radios that search-and-rescue ground teams use. These radios are configured as back-pack radios, freeing the hands of the person carrying them. These antennas will take the abuse of going through the woods, and they will spring back. When they do give out, they are easily duplicated.

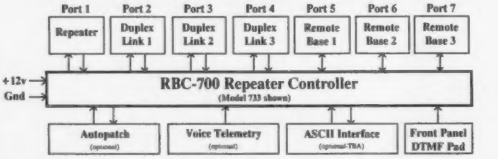
I have found one problem with the antenna completely covered with PVC. If it is rolled up to fit in your shirt pocket, or some other small storage area, it will not unroll quickly. However, this problem occurred at −10° F. Keep this in mind if you expect to be hamming in cool weather. ■

Contact Ruston C. Cable WA6TLK at 4623E. Pinehurst Dr. S., Austin TX 78747.

MULTIPLE REPEATER - LINK - REMOTE BASE CONTROLLER

Finally a controller that has solved control and audio interconnect problems between multiple radios. Your radio system can grow to multiple sites and stretch for hundreds of miles - and yet any radio can be fully controlled from any designated input.





The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

Several models are available and are software configurable to support up to 3 Repeaters, 5 Duplexed Links, and 4 Remote Bases. A group or club can start with the basics and **expand** their controller anytime by simply adding boards and software. Free software upgrades for one year after delivery. Finally, a real controller for the Linked system operator !

Multiple Independent Repeater control
Up to 5 Duplexed Links
Up to 4 different Remotes
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#3 WA7MBL	YAPP file transfers. Written in Turbo pascal. Shell processing
#4 AP LINK	Run both an HF amtor MSO and VHF packet BBS
#5 ROSE	Designed to work with the ROSE networking software for the TNC2
#6 C-BBS	"C" clone of W0RLI BBS. Source also
#7 BB	Multi-connect bbs based on the DED command set. Works with DRSI also
#8 G8UFQ	Works on PK-232. Extensive command set. PCNODE compatible
#9 G4YFB	PBBS from Great Britain
#35 BBSLIST	List of all PBB's in the world. In D-base format and ascii
#36 EZPAC FINDER	Generate NTS traffic offline Emergency locator BBS system
#52 DOSGATE	Run IBM programs remotely via packet radio. Download, mail
#54 KAM-BBS	PBBS for your KAM

RTTY/FAX/CW/SSTV

#23 MSO	Run your own RTTY MSO. Works with dumb TU or HAL PCI-2000 card
#24 Super Morse MORSE TUTOR	Simulated QSO's Random code
#25 MAKE-CW HAMPAK	CW practice Theory tests, cw practice, antennas
#26 AUTOFAX RTFAX	Receive FAX with KAM/PC4, EGA/CGA. Receive FAX with PK-232
#27 RDSSTV	Receive SSTV on your gameport
#62 IBM RTTY	Baudot, Ascii. Works with dumb TU. Also has TNC terminal program
#60 Mean CW SuperEasy	CW tutor (basic) Easy to learn CW
#68 DGRTTY WEFAX WHERITIS	RTTY for HAL Card WEFAX reception for CGA Calculate beam headings.

PACKET TERMINALS

#19 PK232COM TNC	Packet/amtor/cw/rtty for PK232 Simple packet term supports xmodem
#20 LAN-LINK	Packet/amtor/cw/rtty. Robot mode, automatically polls PBBS's for mail
#21 EZ PACK YAPP	XPACKET, XMODEM. Function keys YAPP downloads. Split screen
#22 PTP	XPACKET, XMODEM, Ascii, binary TNC1&2, PK232, KAM, MFJ, AMTOR, RTTY, FAX. Split screen
#29 BSQ&R95 UUCODE	Compress files for sending over PBBS's and over normal TNC's
PACKCOM	Easy packet program. Split screens. Color
#28 DED	WA8DED firmware for TNC1/2 and PK87. Also includes packet terminals

AMIGA

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#32/33/34 PSPICE	Electronic simulation. Up to 10 transistors in this student version
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#53 CHIPS	Database of selected IC's
#56 DROEGE	Circuit Board CAD CGA
#58 RFTOOLS	Calculate noise figures, attenuation, inductance/cap/reactance/VSWR
#59 FILTER2	Audio filter design. Lowpass, bandpass, highpass CGA/EGA. Impressive
#67 Intermod Tubes	Calculate intermod Cross reference for tubes

IBM MISCELLANEOUS

#38 HAM 1	Morse code, rtty, satellites, calculations, sstv and antennas
#39 HAM 2	Coils, USAT, Intermod, great circle distances, network analyses
#40 HAM 3	RTTY, BEAMs, resistor codes
#41 MININEC RFSAFE KEN-440	Mini-numerical electromagnetics RF safety calculations Computer control your TS-440
#42 FIELDA	Field day logger
#43 PC-HAM	Collection of programs. MUF calc, logbook and contesting
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#51 SATRA	Satellite tracking for MS Windows
#57 MILAIR	Over 362K of Military aircraft frequencies. Zipped
#58 AutoLog	Log contacts AND control your ICOM radio with this one program
#59 CONLOG	Sweepstakes logging system
#63 MINIPROP2	Excellent propagation predictions
#64 DXCC	DXCC logging system
#65 WXRDR	WeatherRadar on your PC. Use with ProComm

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#14 & 15 TCP/IP	Source for TCP/IP
#16 THE NET SETNET	Run your own Netrom. Includes net setup. For TNC2/MFJ clones
#17 ROSE X25	Packet switch for TNC2. Works with ROSE BBS
#18 MONAX25	Monitor the performance of your packet lan
#61 UUPC	Receive UUCP mail and usenet on your IBM PC
#66 Estimate TNCParams WHOIS	Estimate packet link performance TNC parameters for various TNCs Find who is who in tcp/ip

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Number 7 on your Feedback card

73 Review

by Dick Goodman WA3USG

The VOR-2 Video Operated Relay

Control your ATV repeater with this versatile circuit.

P.C. Electronics
2522 Paxson Ln.
Arcadia CA 91007-8537
Price Class: $45.
Tel. (818) 447-4565

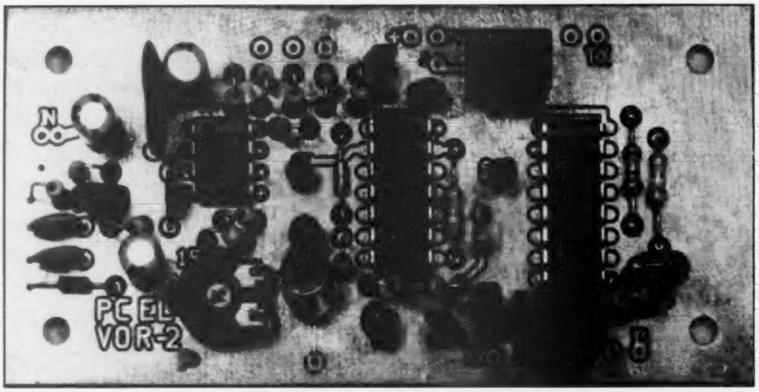

Photo. The P.C. Electronics VOR-2 Video Operated Relay.

About eight years ago the members of the Keystone VHF Club in York, Pennsylvania, decided to build an in-band ATV repeater (439.25 MHz in, 426.25 MHz out). We decided to add a UHF FM receiver from Hamtronics for center carrier audio detection. Most importantly, the receiver would pick off the necessary AGC voltage to drive the COR (Carrier Operated Relay), which activated the repeater exciter upon receiving a signal.

Upon completion of our repeater, our worst problem was receiver desense. This manifested in two ways: interference on the transmitted video in the form of cross-hatching, and an inability of the center carrier FM receiver to properly drive the COR.

Using a spectrum analyzer and judicious tuning of the exciter and PA stages, John Shaffer W3SST eliminated all but a vestige of desense. However, we were never able to make the center carrier receiver drive the COR reliably. We had to come up with something else.

The First VOR

When we began, there were no pre-packaged ATV repeater controllers. Builders of ATV repeaters had to use their ingenuity to obtain proper COR control, receiver "hang time," legal video ID, and the like. I decided to use my knowledge of TTL logic to design a complete ATV repeater controller.

Building the timers, relay drivers, and video switching circuits went quite well. I decided to get rid of the center carrier receiver COR and opt for a system driven by the detection of horizontal sync on the video carrier.

In theory, this would be much more immune to "falsing" and desense than the previous system. The heart of this system was a VOR (Video Operated Relay) board manufactured by PC Electronics in Arcadia, California. This circuit was designed around a NE567 PLL chip tuned to lock on 15.750 kHz. It was connected to the video output of the repeater receiver, and upon receipt of a bona fide ATV signal, would drive a relay and key the repeater exciter.

Initial tests were quite promising. When a strong ATV signal came on-line, the VOR worked perfectly. When the signals got weak (P2 or less), or the transmitting station did not have the correct sync to video ratio, the system would drop out. Since the video waveform is quite complex, the original VOR did not always "see" sync when the signal was weak (mixed with noise) or clipped (distorted/low in amplitude).

This first controller and the repeater functioned well under most conditions, however, and we lived with this system for several years.

The VOR-2

Recently, the club decided to build a crossband ATV repeater (439.25 MHz in/923.25 MHz out). All components were purchased from P.C. Electronics in Arcadia, California. As I started to design a new controller, I noticed an interesting product offered by P.C. Electronics: the VOR-2 Video Operated Relay.

The VOR-2 senses horizontal sync, locks on it, and picks up a relay. It is also designed around the NE567 PLL. There are many substantial improvements and additions to the original VOR design, however. Baseband video from the receive system is connected to the input of the VOR-2. From here it is routed to a sync stripper where good clean horizontal sync is picked off and presented to the 567 PLL. THIS CIRCUIT WORKS WELL!

On our repeater it will key up very reliably on signals down to the level of P-0 (sync bars only!). The "lock on" frequency is adjustable, with an on-board trimpot. This should be set with a frequency counter connected to the appropriate test point with no video applied. The locking range is advertised as plus or minus 800 Hz.

Absolutely everyone who has tried can bring up our repeater, so I have no reason to doubt this. We have users running old monochrome line-frequency derived cameras, camcorders, computer generated graphics, and plain old lousy sync, and they all key the repeater equally well. There is also a built-in 10-second "hang time" to allow for repeater ID and to keep noisy or weak signals from dropping in and out. This delay is adjustable by changing the value of a resistor.

A Complete Repeater Controller

As well as providing excellent COR capabilities, the VOR-2 has virtually all the features of a complete ATV repeater controller. There are two relays on board the VOR-2. One keys the transmitter under control of the NE567 PLL, the other automatically switches the received video to the input of the transmitter when a valid video signal is present. This second relay also switches the exciter video input to an alternate video source during the 10-second hang time when no video carrier is present.

A video source such as a camera aimed at the repeater's callsign, computer graphics with the repeater's ID, or a video character generator/ID board such as the Elktronics VDG-1, will provide excellent and completely automatic video ID. If a video carrier is present

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CT-90 9 DIGIT 600 MHz

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Direct probe, general purpose use, DC-1	$16.95
Tilt bail, elevates counter for easy viewing, TB-70	$ 9.95
Rechargeable internal battery pack, BP-4	$ 9.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1	59.95

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MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	< 25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	< 50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	< 10 mV to 150 MHz < 150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	< 25mV to 50 MHz < 15 mV to 500 MHz < 100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	< 25 mV to 50 MHz < 10 mV to 1 GHz < 50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$239.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	< 50 mV	Convert your existing counter to 1.5 GHz		$89.95

SPEED RADAR

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complete kit
SG-7

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes delivery. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.

PR-2, wired, includes AC adapter $59.95

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Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

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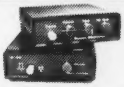

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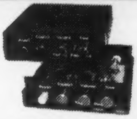
Matching case set for SCI,CSC $12.95

2, 6, 10 MTR, 220 FM RECEIVERS



Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.

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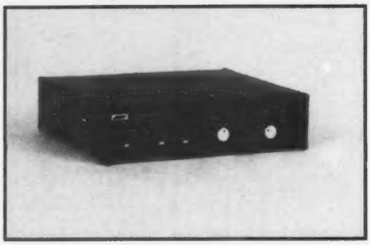

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for more than nine minutes on the repeater input, the VOR-2 will automatically switch to the second video source for about five seconds to meet the FCC's ID requirement. Both of these periods may be changed by changing the appropriate resistors on the VOR-2.

We have the VOR-2 and an Elktronics VDG-1 Video ID board packaged together in a Bud RF-proof mini-box in our repeater. Together they function as a complete ATV repeater controller in an area of about 7" x 4" x 2". We had only one problem with the VOR-2. Because the NE567 PLL COR is extremely sensitive, we had some very slight receive desense that caused the VOR-2 to lock on itself. This was cured by installing the VOR-2 in an RF-tight box, using feed-through capacitors on all inputs and outputs and an interdigital filter on the 439.25 MHz receive feedline, and keeping the receive and transmit antenna separation greater than 10 feet. This repeater has been in operation for over a year now with no other problems.

Other Uses

The VOR-2 can be used for applications other than repeater control. It may be used to activate a VCR whose input is set to the repeater output frequency (through a downconverter). The relays on the VOR-2 may be interfaced to the VCR to operate the record function when video is present. An interface could also be built to apply or remove AC power from the VCR if desired.

An inexpensive Sonalert may be purchased and energized when video from the repeater is present, which would be an excellent way to monitor activity when you're away from the shack. This would also be a good way to monitor security at your club site. In your shack, the VOR-2 could be used to energize your ATV equipment when video is detected from any video source. Finally, the VOR-2 could relieve you of remembering to video ID your station at the appropriate 10 minute intervals.

The documentation supplied with the VOR-2 consists of a single data sheet. Full schematics are included, as are suggested operating configurations. This is more than adequate, considering the ease of hooking up this circuit. Don't let the VOR-2's simplicity fool you, however. The VOR-2 coupled with some form of video ID generator fulfills all the requirements of a capable ATV repeater controller. 73

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The Megaloop

Perfect for megalomaniacs.

by Stan Gibilisco W1GV

Have you ever wondered what would happen if you connected your HF transceiver via a transmatch to an infinitely longwire? Or to a wire 100 miles long? Or to a loop running all the way around the state line of, say, Kansas?

Most hams have heard old-timers tell stories of finding an unused telephone line a few miles long and using it as an antenna to work the world on a few watts.

A couple of years ago, following a serious accident, I returned to my parents' home to recuperate. I got on the air with the help of some old ham friends who donated time, muscle, and equipment. During that winter, I put up a longwire measuring 880 feet, and got great results. It was a good performer on all bands 80 through 10 meters, and wasn't bad on 160, either. Mel Larson KC0P had advised me to put up a longwire if there was any opportunity; he said I wouldn't regret it, and I didn't.

Nor do I regret my most recent experiment, a huge horizontal loop of wire that I call the megaloop.

A Far Out Concept

An infinitely longwire or loop, if either were possible, would have certain characteristics. First and most significant is that a change in frequency would make no difference whatsoever in the performance of the antenna in free space. It would have an infinite number of current loops, no matter what the wavelength of the signal applied to it. The impedance would be purely resistive; there would be no standing waves because no power could be reflected from the end of an endless antenna.

I've done some experiments that suggest that an antenna of about 50 wavelengths or more may be considered, in practice, infinitely long. As the electromagnetic field propagates from the feedpoint of such a longwire, the current and voltage loops diminish in magnitude the farther one gets from the station. See Figure 1(a). This is because the field radiates as it travels, and this radiation, along with ohmic loss in the wire itself, dissipates the signal. Even with a perfectly conductive wire, this effect would take place, solely because of the radiation resistance of free space. By the time the field has gone about 50 wavelengths, most of it is gone forever into the vacuum of space. If the longwire were a loop measuring, say, 100 wavelengths in circumference, you'd observe a similar effect. See Figure 1(b).

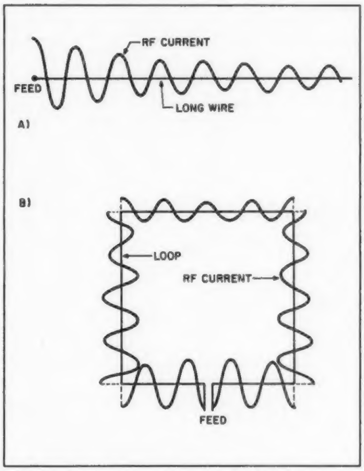

Figure 1. Current intensity diminishes as the electromagnetic field travels away from the feedpoint. (a) An antenna 50 wavelenghts long may, in practical terms, be considered infinite.... (b) A 100-wavelength loop with similar characteristics.

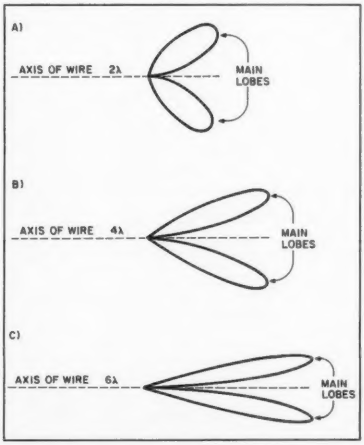

Figure 2. Main lobes for terminated longwires at different wavelengths.

The vacant field to the north of my parents' house measured about 700′ x 1200′, the long way being east-west. In 1987-88, I ran the 880-foot longwire from the house to the west-northwest; in 1989, I ran a loop around as much of the field as I could manage. I don't know exactly what the circumference was, but it was probably about 3800 feet, or 0.7 miles.

Directional Effect

This is the second most important characteristic of an arbitrarily longwire. A large, strong lobe develops when a wire becomes more than a few wavelengths long. There is a limit to how much gain can be realized from this lobe. See Figure 2. This is because of the effect of radiation loss mentioned above; but certain long-wire configurations, like the terminated rhombic, can have around 30 dB of power gain relative to a half-wave dipole.

Minor lobes, now shown in Figure 2, also appear, and they become more numerous as the wire is made longer. An infinitely longwire would theoretically have infinitely many minor lobes. A wire 50 wavelengths long would have so many minor lobes that we might think of them as a single field; they would tend to blend together because of wire sag and ground effects from nearby objects.

Bending the wire into a loop might be expected to eliminate the directional effects and cause the minor lobes to more completely blend. The result would be a fairly uniform radiation pattern as long as the loop was small enough to allow some of the electromagnetic field to travel all the way around. A loop of infinite circumference, or many miles, would behave essentially as a straight longwire fed somewhere along its length and running off forever in opposite directions.

My loop was about 100 wavelengths at 10 meters, 50 wavelengths at 20 meters, and 25 wavelengths at 40 meters. Especially towards the top of the HF spectrum, the megaloop is like an infinitely long, straight wire. But at 80 and 160 meters, it is not so overwhelmingly large, and can be expected to have nearly omnidirectional characteristics. The polarization would be horizontal on all bands. The antenna height above ground would ideally be at least a quarter wavelength, or 33 feet at 7 MHz, 66 feet at 3.5 MHz, and 130 feet at 1.8 MHz. I was able to get most of the antenna up about 50 feet, the height of trees around the field. I got wires over the trees using kites of the inexpensive, dime-store variety (bat kites).

And the Third Characteristic...

Diversity! The antenna covers such a large area that if fading is taking place in one spot, reception may be good at another spot. This diversity effect is observed with all longwires or rhombics, and it works for the phasing type of fading, where different components of an incoming field arrive in phase some of the time, and out of phase some of the time.

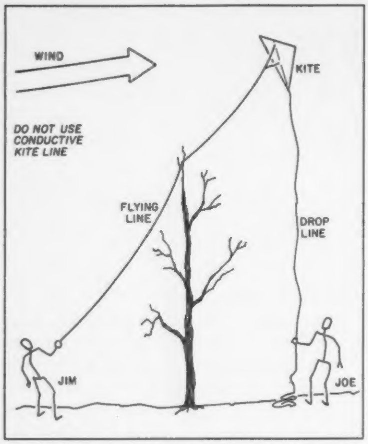

Figure 3. The kite technique works best with two people, so one can guide the flying line, and the other, the drop line. Only nonconductive line should be used for this operation.

Fading that occurs because of ionospheric absorption or a change in the maximum usable frequency (MUF) won't be reduced by diversity techniques. It's reasonable to expect that the diversity of the antenna would operate in transmit as well as in receive mode so that other stations would note less fading with the megaloop than with a small antenna such as a quarter-wave vertical, under conditions when multipath fading occurs.

The vacant field was scheduled for development, so the time was limited. I had to try out my idea of the megaloop during the winter of 1989–90, or never. This, plus the desire to grandly command the helm of such a device, motivated me to do it. Also, I hadn't heard much about anyone else having done it, though surely it has been tried before.

Materials

I used aluminum fence wire, Baygard®6 for the radiator. This six-strand wire, reinforced with nylon, is light and strong. It comes in rolls of a quarter-mile each. I bought three of these and used just about all of the wire for the megaloop.

With some nylon twine and a few old bat kites, I snagged the wires up in the trees, even though the wire is bare. In Minnesota, trees are fairly good insulators if it is below freezing. A good breeze, about 15 mph, facilitated the kite technique. See Figure 3. Also indispensable were warm mittens, as the temperature hovered around zero.

Feeding and Grounding

The megaloop can be fed in two ways. The preferable method is to bring the ends of the loop together into a parallel-wire line. See Figure 4(a). Then, to connect this line to the output of a transmatch equipped to deal with this kind of line.

If your transmatch does not have a two-wire line output, you may connect one end of the loop to the center conductor pin of the coaxial output, and the other end to chassis ground. See Figure 4(b).

Or you may leave one end of the loop free and connect the other to the center conductor pin or single-wire terminal. See Figure 4(c).

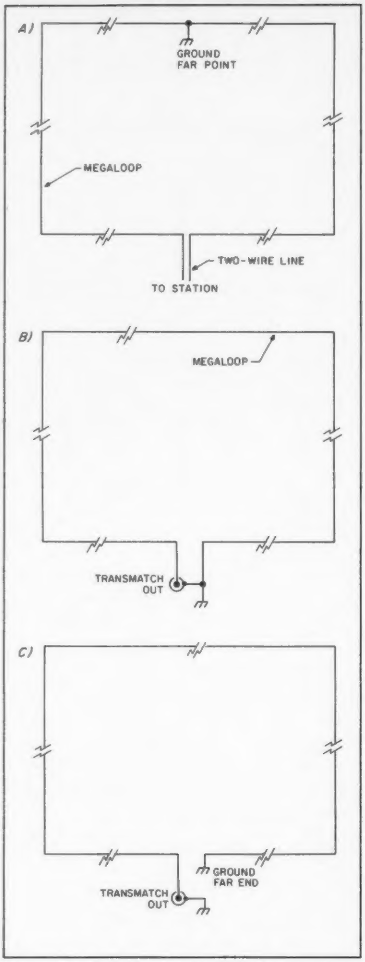

Figure 4. (a) Two-wire line is the preferred way to feed the antenna. (b) You can also feed the antenna with a transmatch having only single-wire or coaxial output. (c) An alternative method of coaxial feed.

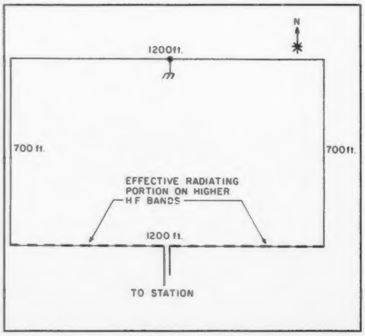

Figure 5. On the higher HF bands, only the southernmost leg of the loop at W1GV was really contributing to the radiation and reception in the megaloop antenna system. Nonetheless, the same basic advantages were realized.

In this case, the megaloop becomes a long wire bent into a circle.

I would recommend methods 4(a) or 4(b), but whichever method you use, a transmatch is necessary.

If the feed method at 4(b) is used, the loop is grounded for direct current, and this is good. Such a large antenna will develop electrostatic voltages because of atmospheric effects. It will actually be a hazard in or near thunder showers unless it is grounded for direct current. *Always, always disconnect the antenna from the rig when you are not on the air, winter or summer, storms or no storms. And never operate during thunder showers or lightning.*

With method 4(a), the loop should be grounded for direct current at a point opposite the station, or as nearly opposite as you can get. An eight-foot ground rod, driven into the earth well away from tree roots (copper can kill trees), and some buried radials, will ensure that you don't get clobbered when you touch the antenna wire. Some transmatches "ground" the antenna via the output of a two-wire feed balun. Do not rely on your transmatch for grounding, however, since some do not have this feature.

Putting It to the Test

Whatever theory may tell us, the way to decide how well an antenna works is to use it. Just because it will produce contacts does not mean that an antenna is a good radiator. I have worked stations over 1000 miles away by loading up a pair of ground rods spaced a quarter-wavelength on 20 meters. And you can work DX on a lightbulb.

Since I knew that a quarter-wave vertical with several radials is not a bad antenna, I compared the megaloop with a balloon-supported vertical on 40, 80, and 160 meters. A length of tubing was sufficient for a quarter-wave vertical on 20, 15, and 10 meters. (My radio doesn't cover the new WARC bands.)

The quarter-wave out-transmitted the megaloop on 160, and was comparable with the megaloop on 80 meters. Of course, that's no surprise. The megaloop did work better for close-in stations on 80; that may be attributed to the better high-angle radiation from the megaloop on this band.

As for reception, the megaloop was superior to the balloon vertical on 160 meters. The vertical was just too noisy. There was little difference on 80 meters, although some close-in stations were louder on the megaloop than on the vertical. The megaloop at W1GV was center-fed and grounded (marginally, because the earth was frozen) at the far side. This might be expected to reduce noise somewhat, along with the horizontal polarization and the comparatively low placement of the antenna (only 50 feet above the ground).

On 40 meters and above, verticals and the megaloop were just about equal for transmitted and received signal strength. This would be the expected result; both antennas are omnidirectional (essentially) and neither has any appreciable gain, except maybe on 10 and 15 meters. The feedpoint at W1GV was roughly in the middle of a long east-west run of wire,

Continued on page 44

HF Equipment	Regular	SALE
IC-781 Xcvr/ps/tuner/scope •*Special*.	$6149.00	4999

IC-765 Xcvr/ps/keyer/tuner	$2692.00	2399

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FL-53A 250 Hz CW filter (2nd IF)	115.00	109^{95}
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IC-735 HF xcvr/SW rcvr/mic	1149.00	969^{95}
PS-55 External power supply	219.00	199^{95}
AT-150 Automatic antenna tuner	445.00	389^{95}
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	

IC-725 HF xcvr/SW rcvr	$949.00	799^{95}
AH-3 Automatic antenna tuner	489.00	429^{95}
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IC-4KL HF 1 kw amp w/ps • *Special*	6995.00	5795
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PS-15 20A external power supply	175.00	159^{95}
PS-30 Systems p/s w/cord, 6 pin plug	349.00	319^{95}
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SP-7 Small external speaker	51.99	
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SM-6 Desk microphone	47.95	
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IC-275H 100w 2m FM/SSB/CW	1399.00	1199
IC-475A 25w 440 FM/SSB/CW w/ps	1399.00	1199
IC-475H 100w 440 FM/SSB/CW	1599.00	1399
IC-575A 25w 6/10m xcvr/ps	1399.00	1199
IC-575H 25w 100w 6/10m xcvr	699.00	1469
IC-1275A 10w 1.2GHz FM/SSB/CW	1849.00	1599

VHF/UHF FM Transceivers	Regular	SALE
IC-229A 25w 2m FM/TTP mic •*Special*	$423.00	319^{95}
IC-229H 50w 2m FM/TTP mic •*Special*	462.00	379^{95}
IC-448A 25w 440 FM/TTP • *Closeout*	599.00	469^{95}
IC-1201 10W 1.2GHz FM xcvr	799.00	699^{95}

Dual band FM Transceivers	Regular	SALE
IC-3220A 25w 2m/440 FM/TTP mic	$659.00	569^{95}
IC-3220H 45w 2m/35w 440 FM/TTP	699.00	599^{95}
IC-2400A 2m/440 FM/TTP • *Special*	899.00	639^{95}
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UX-39A 25w 220MHz unit	349.00	319^{95}
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IC-4GAT 440MHz/TTP	449.00	369^{95}
IC-12GAT 1.2GHz/TTP	529.00	469^{95}
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IC-24AT 2m/440 HT	565.00	419^{95}

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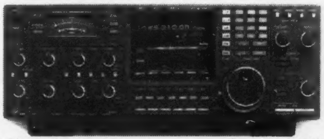

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Lightning Protection

Want some peace of mind?

by Frank A. Finger NU1A

We've all heard gruesome tales of damage caused by lightning. Many articles have been written about how to protect your valuable electronic equipment. All of the suggestions are valid, and if followed, will give some measure of protection. In this article, I'll cover some new methods as well as some of the accepted schemes. Anything to protect that expensive equipment is worth trying!

Believe It or Not

While reexamining one of my old physics books, I came across a formula for the discharge from a sphere. My attention was attracted to the following sentences. "It has been previously shown that the maximum charge that can be retained by a conductor in air is limited by the fact that the air itself becomes conducting at an electric intensity of about 3 x 10^6 volts per meter. $V_m = a \bullet E_m$. E_m is the maximum voltage; a, the radius of the sphere. For a sphere one centimeter in radius, $E_m = 30{,}000$ volts, and no amount of 'charging' can raise the potential of a sphere this size, in air, higher than 30,000 volts."

The implications of this are almost unbelievable.

Since the maximum potential at the sphere is directly proportional to the radius, suppose we make the radius very small? A pointed wire or rod is a sphere of very small radius. Now this pointed wire will discharge into air at a potential of a few hundred volts! This means that the area around the tip of the wire can not exceed a few hundred volts, and it will be impossible for a voltage buildup of the extremely high potential needed for a lightning strike. Boy, can we use something like that!

Automobile antennas used on cars in the early '30s were just a piece of hard wire mounted on an insulator. The wire would wipe electrons from the air, and as charges built up they would discharge into the air. The result was static. Using the above theory, an engineer came up with the idea of putting a small ball on the top. This increased the discharge potential so that discharges were no longer causing noise and we had quiet reception at last. Those little balls on the ends of our auto antennas are not just for decoration.

The Genesis of Lightning

As a thundercloud builds up, strong air currents form inside it, updrafts being the strongest. As particles of air pass particles of moisture, electrons are dislodged. In a short time, this creates large areas of negative charge and positive charge. Eventually, the voltage reaches the breakdown point, and lightning discharges the areas.

As the cloud moves across the sky, a charge of equal but opposite value follows along on the ground under the cloud, much like the shadow a low-flying airplane would make. When the charge builds to several million volts, we eventually have a lightning bolt, which discharges the area. Then it begins all over again.

As the ground charge passes under your tower, it charges up your tower and reduces the distance from the ground to the cloud by several tens of feet. If the charge reaches a critical value, we have lightning hitting your tower. The challenge is how to prevent this high charge buildup.

The Pointed Rod

Using the theory noted above, let's mount a very sharply pointed rod on a pipe extending above your beam or tower. Theory says the potential at the sharp point can not exceed a few hundred volts. This will NOT allow the charge to build up to the millions of volts needed for discharge. The result: no lightning strike! Why do you think they make lightning rods pointed? You guessed it—someone already thought of this, but failed to apply it to amateur radio! I am re-inventing the wheel, so to speak.

I live on a hill above a lake. I have two towers, the tallest being 60 feet. The beam support pipe sticks up another eight feet, and mounted to this is my sharply pointed rod. In 20 years I have never had a lightning hit, although trees around the neighborhood and some TV antenna towers have been hit.

The United States power squadrons say that you have a cone of protection spreading out from the point at about a 30 degree angle. Nice protection for the home and the trees in the yard.

Yes, theory really works.

Using Inductance

Often lightning strikes nearby, inducing large pulses of energy into nearby telephone and power lines. The large pulses find their way into our homes via the wires. Transistorized and integrated circuits are especially vulnerable. What can we do?

Again, let's go to theory. Remember the coil? It offers AC resistance called inductance. The lightning-induced pulses are half cycles of alternating voltage at very high frequencies, so a coil in the attachment cords should work quite well. Let's tie several plain knots in the cords and we have quite effective protection. Sounds silly, looks ugly as sin, but it works great.

I have seen receptacles blown out of the wall, and the equipment with knots in the cords undamaged. It works. Easy coils, I call them. The coiled cords on telephone handsets are good protection to a person talking on the phone during a thunderstorm. Lots of inductance there.

Those of us with computers and modems to the telephone line can protect our modems with knots in the cord, though it would be neater, and probably more effective, to wrap the cord a number of turns on a ferrite core.

At the base of your tower, it's a good idea to install a gas discharge tube in the coax line. Next, you can use inductance again by making a small coil of several turns in your coax cable, taping them in place with electrician's tape. It doesn't affect your RF energy. The coils impede the lightning pulse, and the gas discharge tube passes it to ground.

Of course, a good ground system will help immensely. Run a good ground wire from your tower to a good ground rod, then around your house to the telephone or power company ground rod. This wire buried under a few inches of earth will give a good ground. If you have several towers, adding a good ground wire to connect them all provides additional protection. I once asked an engineer how large a wire to use. He said, "The fatter the better." But I think a #6 or #8 guage wire gives reasonably good protection for the money.

A G.E. engineer discussing similar protection for their remote repeater sites on mountains said that measures like these probably provide about 90% protection. He said that someday the granddaddy of them all might come along and zap your installation, but the items suggested would be about as good as you can do.

Another suggestion was to run about two lengths of iron conduit up the tower leg and strap it tightly to the tower, then run the cables through the conduit. It will act as a one-turn short and prevent the pulses from propagating down the coax and into the house.

I never disconnect my radio equipment during storms, and I've never had any damage. It is nice to be able to so cheaply protect my equipment and home at such reasonable cost. A few knots, a pointed rod, a few feet of ground wire, and a couple pieces of pipe sure can give you peace of mind.

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The Flight of STS-37

The first "all-ham" crew.

by Philip Chien KC4YER

The flight of STS-37 was a shuttle mission that seemed to be designed specifically for the amateur radio community. All five astronauts had their ham licenses, and the ham activities would include slow-scan, packet, and voice operations, and the first attempt to receive live television aboard the shuttle, plus—with some luck—a direct contact with the Soviet space station *Mir*. The mission would also include the deployment of one of the heaviest scientific spacecraft launched and the first post-*Challenger* spacewalk.

The *Atlantis* launch had originally been planned for November 1990, but hydrogen leaks in the main propulsion system delayed the launch until April 1991. The delay actually helped in one way: Pilot Ken Cameron KB5AWP convinced his fellow crewmembers (Commander) Steve Nagel, (and mission specialists) Jay Apt, and Linda Godwin to get their ham tickets, but (mission specialist) Jerry Ross was the hold out. Jerry promised the rest of the crew that if the launch delayed beyond November he would get his ticket, and when the launch was delayed he kept his promise and got his technician's license. The crew was extremely enthusiastic about the SAREX experiment, and Steve Nagel quipped, while introducing the crew, "Other crews may claim to have a ham or two aboard, but this is the first 'all ham' crew."

Pre-Launch Tests

To check out the SAREX hardware on *Atlantis*, Lou McFadin W5DID, an Aerospace Engineer at the Johnson Space Center (JSC), came to the Kennedy Space Center (KSC) along with Jerry Coles KB5ARA of JSC, John Stahler WB6DCN of Robot Research, Andy Bachler N9AB of the Motorola ARC, Schaumberg, Illinois, and Kai Siwiak KE4PT of Motorola, Ft. Lauderdale. KSC ham Mike Peacock KC4UGT loaned us his transceiver and helped us as a third hand and escort (see Photo E). (*Atlantis*'s hangar, the Orbiter Processing Facility, is considered a hazardous facility because of the poisonous fuels and high pressure gasses, and whenever anybody's in the building they have to be escorted by a trained person like Mike.)

While plenty of tests had been performed in the JSC shuttle simulators, a set of SAREX tests was planned for KSC using *Atlantis*'s flight hardware. These tests would verify the actual SAREX flight hardware in the identical configuration which the astronauts would use during their mission.

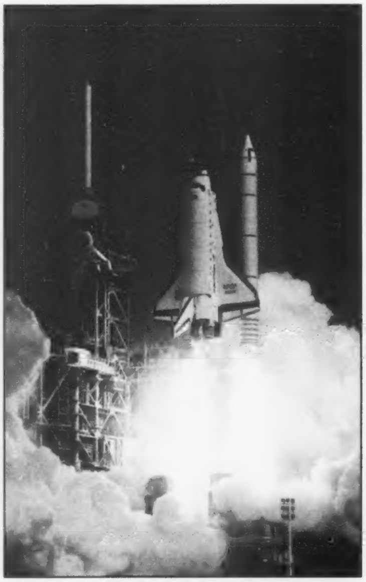

Photo A. Liftoff of the Atlantis. *Photos A-F courtesy of NASA.*

Photo B. Pilot Ken Cameron KB5AWP makes a voice contact while in orbit.

Preparing the orbiter for flight is always an extremely hectic activity with many different tasks going on at the same time. We set up the prototype ROBOT box, a Sony Camcorder, a Panasonic VHS VCR/monitor, a 2 meter transceiver, and a Grid computer—basically non-flight versions of the SAREX hardware—plus a fast-scan TV transmitter on a test table close to *Atlantis*'s crew cabin. Since we were just a couple of feet away from the orbiter and it wasn't going to move anywhere, we didn't need a tracking antenna. Our fast-scan TV antenna was a helical antenna mounted on a broom handle stuck into a vise.

It took about 90 minutes to get everything configured in *Atlantis* and on the workbench.

HARVARD
STS 37
Atlantis

Photo C. Mission Specialist Jay Apt N5QWL with SAREX equipment at the ready.

Photo D. Mission Specialist Linda Godwin N5RAX prepares to make a few ham contacts.

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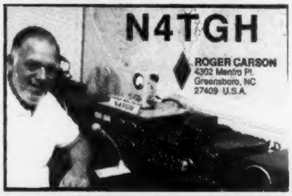

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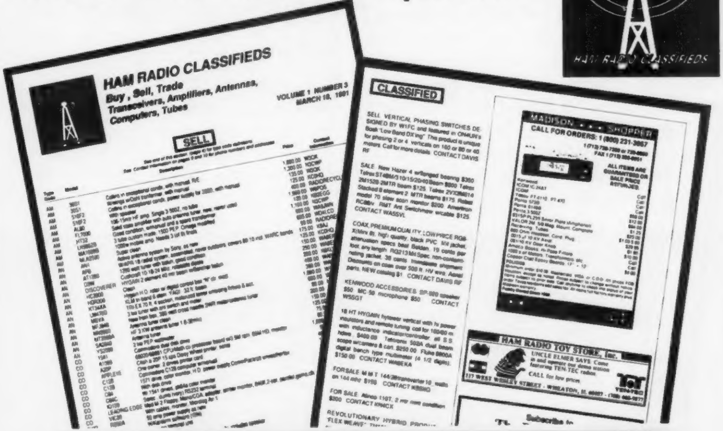
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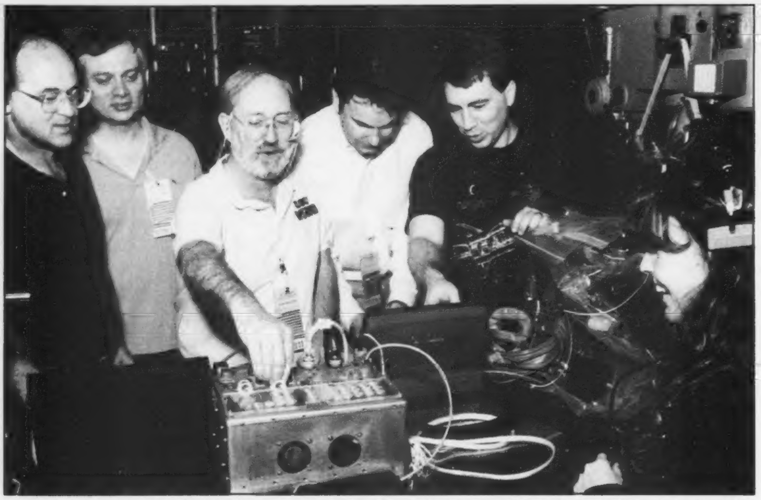

Photo E. (l to r): Kai Siwiak KE4PT, Andy Bachler N9AB, Lou McFadin W5DID, John Stahler WB6DCN and Jerry Coles KB5ARA perform pre-launch tests of the SAREX hardware as KSC technician Renee Wolf looks on. On the workbench (l-r) the PGSC (Payload General Support Computer)—a modified Grid laptop computer, the SAREX ROBOT box, and the Panasonic VCR/monitor.

Everything was ready, and the voice, packet, and slow-scan tests went fine. We QSOed the shuttle from the ground using handheld 2 meter transceivers. The voice quality was excellent—but of course we were right next to the shuttle and didn't have to compete with anybody else! Technically, though, we could say that we had QSOed *Atlantis*'s SAREX—even though it was just a couple of feet away! We weren't able to complete the fast-scan TV tests due to a faulty test transmitter. It was determined that the ATV receiver in the orbiter was functional, however. After a final verification, the SAREX hardware was packed in its flight locker and shipped to KSC on March 21st and installed in *Atlantis*'s crew cabin.

Photo F. Students from the Clear Creek school district (Houston, Texas) contact the Atlantis *from the Johnson Space Center visitor's center. (l to r): Gil Carman WA5NOM (seated at the tracking computer). Standing: Joey Kramer, Tracy Singleton, Kyle Beasley and Steven White. Standing to the far right is Chuck Biggs KC5RG (Chief of the Public Services Branch at NASA JSC).*

Photo G. Lyman High School (Longwood, Florida) students applaud their successful contact with astronaut Ken Cameron KB5AWP aboard Atlantis. Standing (l to r): Dick N0HOM, Russ WA3IBE, Fred N4NVW, Jennifer McCarrick, Mike KC4OHH, Jose Lopez, Gary Davies, and teacher Joe Laughlin KC4UBY. Seated (l to r): Ed W0RAO, John KC4IYO and Rick KC4ONA. Not shown is Joe Singer N4IPV. Photo by Phil Chien KC4YER.

Liftoff!

Atlantis's launch was planned for April 5, 1991, at 9:18 a.m. EST. Bad weather at the launch site, and range requirements, delayed the launch by 4 minutes and 45 seconds to 9:22:45 a.m. The ground shook and the skies roared as *Atlantis* took off on the 39th shuttle flight—just one week before the tenth anniversary of the first shuttle launch. Within three hours Ken opened up the middeck locker where the SAREX hardware was stowed and set up the rig next to his seat on *Atlantis*'s flight deck.

Atlantis was placed in a 28.5 degree inclined orbit to permit as much payload as possible, and was launched into a fairly high orbit (460 km or 243 nm.) to place the Gamma Ray Observatory as high as possible, permitting the longest possible lifetime. The high altitude increases the look angles for ground viewing stations, an extremely important issue for viewers at high latitudes. Since *Atlantis* was launched relatively early in the morning, most U.S. passes occurred during the daytime, much more convenient than STS-35's nighttime passes. However, with a planned five-day mission, STS-37 was the shortest SAREX flight to date.

As a secondary payload, SAREX only gets access to the orbiter's resources (including crew time) when it doesn't interfere with other operations. During the STS-35 Astro-1 mission last December, *Columbia* had to be pointed precisely to aim it at different objects in the sky. The continuous pointing resulted in relatively poor antenna angles. For STS-37, *Atlantis* was positioned for the best reception for many of the planned SAREX contacts.

School Contacts

NASA flies SAREX as part of its education program to help inform the public, especially students, about the space program. Consequently, the primary scheduled SAREX activities are pre-arranged contacts with schools. For STS-37, the schools were: Clear Creek independent school district, Houston, Texas; University School, Shaker Heights, Ohio; Discover Center Museum, Rockford, Illinois; Potter Jr. High School, Fallbrook, California; Hanover Elementary School, Bethlehem, Pennsylvania; several interconnected schools in southwest Oklahoma; Lyman High School, Longwood, Florida; Monroe Central School, Parker City, Indiana; Beaver Creek Elementary School, Dowington, Pennsylvania; and Reizenstein Middle School, Pittsburgh, Pennsylvania.

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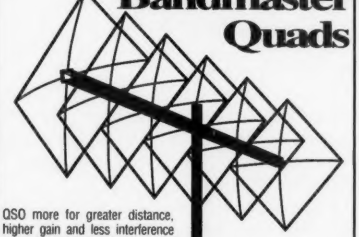

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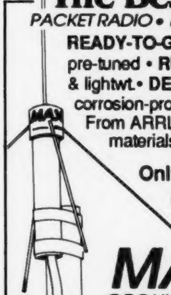

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SAREX in the Future

NASA's current shuttle manifest does not show any official assignments for future SAREX flights, but there are several opportunities. AMSAT and the ARRL have asked NASA to fly SAREX on the STS-42 mission, currently scheduled for early 1992. On that mission the astronauts will operate the International Microgravity Laboratory (IML-1), a set of Spacelab microgravity experiments. IML will be launched into a high inclination orbit which will cover the Earth to 57.1 degrees north and south of the equator. The SAREX team is especially interested in flying high inclination missions to permit wider access to more hams around the world, especially U.S. hams in the central and northern latitudes. In addition, SAREX may fly on the STS-45 ATLAS-1 (ATmospheric Laboratory for Applied Sciences) mission in April 1992. It's likely that if schools continue expressing interests in participating in SAREX contacts, there will be more amateur operations aboard the shuttle in the future. The best way to let NASA know that there is interest in SAREX is to send letters to NASA's Education and Public Affairs departments at NASA Headquarters, Washington DC 20546. Letters to the ARRL and AMSAT are appreciated, but NASA needs to know that hams and teachers are interested in SAREX and the shuttle program.

If you're a teacher interested in participating in future SAREX missions, or know a teacher who may be interested, contact the ARRL at 225 Main St., Newington CT 06111. For the hams who cooperate with local schools, it's a rewarding activity and an excellent way to spend an afternoon (or evening or morning, depending on when it occurs). For the teacher it requires a fair amount of planning ahead of time, especially preparing the students and informing them about SAREX and the shuttle missions where you will be participating in. There can be frustrations—when the shuttle launch delays, when the encounters occur at inconvenient times (like during vacations or lunch time), when there isn't a high quality connection, etc. Everybody learns a lot even when things don't go perfectly, but when everything works—it's fantastic!

The Phone Bridge

To extend SAREX's capabilities to contact more schools outside of the flight path, the SAREX team uses a set of relay stations and phone bridges. The Figure shows how the phone bridge works for a typical school contact. The pre-arranged relay stations which communicate with the shuttle are located in Holtsville, California; Corpus Christi, Texas; and Ft. Myers, Florida. Other relay stations are located in Ecuador and Brazil for more southern orbits, and Australia for additional Australian school contacts. The relay stations use a phone network to conference call with SAREX control and a local ham contact close to the target school. The contact near the school patches the phone bridge into the local repeater, and the students talk on the repeater via a control operator located at the school. It's extremely complicated, and with five separate RF and hardwire segments there are occasional dropouts or weak connections.

Ask an Astronaut

The first STS-37 school contact was with students from Clear Creek independent school district who visited the Johnson Space Center and SAREX Control (see Photo F). As *Atlantis* came over his horizon, Ralph Warner N6MNN tried to contact the shuttle. It took several tries and about four minutes to get a good connection with Ken aboard *Atlantis*. The strength of the signal for this pass was fairly low, and the ground stations had to repeat the questions so Ken could understand them. As the orbiter went across the country, Bob Douglas W5GEL in Corpus Christi, Texas, and Don Carlson W4RDI in Ft. Myers, Florida, took over. All together, Ken and Commander Steve Nagel answered ten questions about their mission and training during *Atlantis*'s 19-minute pass.

I visited Lyman High School in Longwood, Florida, on flight day two to watch their attempt to talk to *Atlantis*'s crew (see Photo G). Joe Laughlin KC4UBY teaches a popular "Space, Technology, and Engineering" class and went all out for the SAREX contact. An essay contest determined which students would get to ask the astronauts questions. He took the lucky students to the Kennedy Space Center to see *Atlantis*'s launch on Friday.

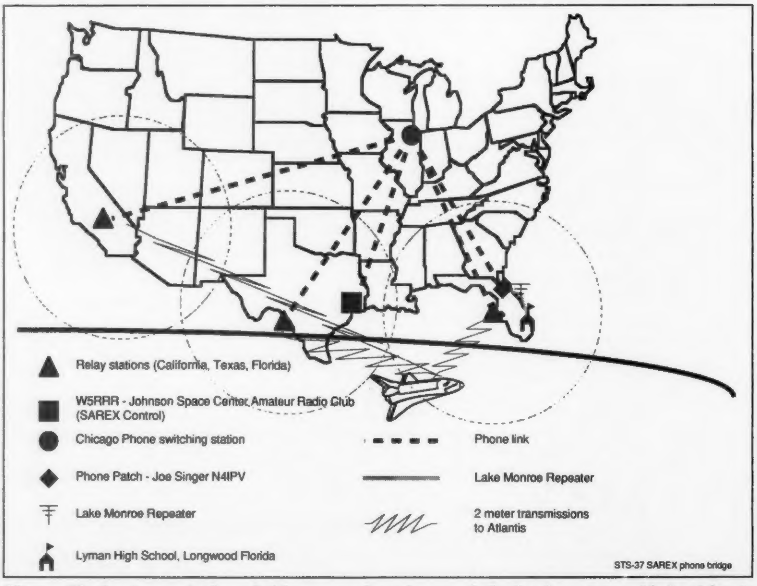
The Lake Monroe Amateur Radio Society had set up their gear in Lyman's auditorium. John Rothert KC4IYO at the school contacted Joe Singer N4IPV at his home via the local repeater. Joe was connected via the phone patch with SAREX control and the relay stations.

For this pass, the California, Texas and Florida relay stations were used to relay questions from Potter Jr. High School and Monroe Central School, too. By the time SAREX control got to Lyman High School there was barely time for student José Lopez to ask Ken his question. Unfortunately, by the time Ken understood the question and started answering, *Atlantis* had passed over the Atlantic Ocean and out of range of the Ft. Myers relay station.

The next school contacts, an orbit later, went better. Ken talked with students at the Pennsylvania schools, and once again the last school didn't get a chance to get their question answered. Since the shuttle's orbit precesses to the west, the relay stations for that pass were Ted Jaramillo HC5K in Ecuador and Junior Torres DeCastro PY2BJO in São Paulo, Brazil. Ecuador wasn't able to connect to Ken successfully, but Junior was able to connect with Ken and patch in the students via the phone bridge.

We heard the good news just after that pass was completed. Since it had gone well, and the astronauts were willing, a backup pass would be used for Lyman High School and Reizenstein Middle School because we didn't get our questions answered! We immediately called the students who had gone home and told them to come back—they were going to get another chance!

As with the first time, Joe Singer called the phone bridge and we talked to him via the Lake Monroe repeater. We were hooked up with the relay stations over the phone bridge as the shuttle came over the horizon at Ecuador and everything was set. Then disaster struck—the repeater went down! Fortunately, the repeater came back up just in time


▲ Relay stations (California, Texas, Florida)
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● Chicago Phone switching station
◆ Phone Patch - Joe Singer N4IPV
Lake Monroe Repeater
Lyman High School, Longwood Florida
Phone link
Lake Monroe Repeater
2 meter transmissions to Atlantis
STS-37 SAREX phone bridge

Figure. The intricate telephone bridge network made extended school contacts with the Atlantis a possibility thanks to relay stations located around the world. Figure by the author.

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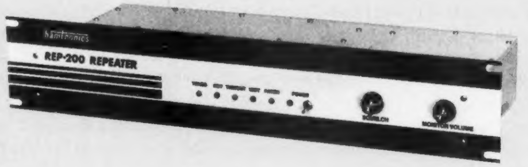

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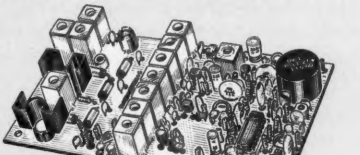

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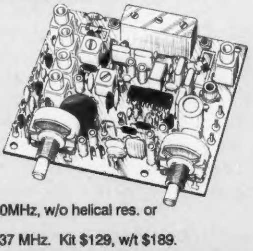

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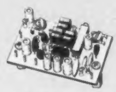

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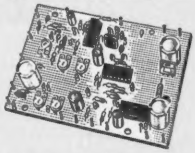

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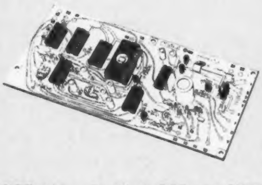

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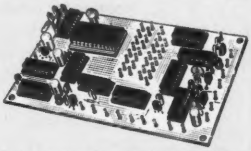

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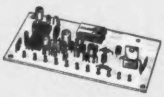

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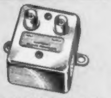

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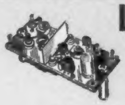

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FT-736R, All		ll $
FT-470 2m/70cm		Call $
FT-747 Gen'l		Call $
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FT 790 R/H	0	Call $
FT 4700 Dual Band Mo e	0	Call $
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CIRCLE 153 ON READER SERVICE CARD

SAREX Comments From the Crew of STS-37 (from the Post-Landing Crew Press Conference)

Ken Cameron explained to us about the STS-37 attempts to contact *Mir*: "We had a couple of tries at contacting *Mir*. The ground had sent up messages letting us know when we had close passes, or what we call conjunctions. The closest was about 190 km. We called them repeatedly. There were arrangements for them to listen on a certain frequency. Unfortunately, there was still a lot of interference, probably due to other folks using their radios for other reasons on that frequency. We called them and we heard them calling us back. So, depending on your definition of real contact, I felt we contacted them. Certainly there were two small spacecraft up there orbiting the Earth, which were calling out for each other. That in itself is fairly significant—even if we didn't exchange words of great diplomatic importance. We were both up there, little points of light, and we tried to reach each other and share the view and share our thoughts. I really couldn't get an RST in the conventional sense—it was almost a one or a zero the way the radio was working. I heard Musa speaking English. I also heard over that area of the South Pacific what I thought at first was Russian, but I think it was just some other language that someone was transmitting in the area. I really couldn't tell. I tried Russian myself on Musa, but it probably didn't sound so red hot if they heard it. But I did my best after some college Russian classes. But Musa was speaking English."

Jerry Ross added: "We also did see *Mir* go across the sky just as the ground called up to us to look at the Big Dipper, and we poked our heads in all different windows and I was the first to spot it. Everybody else got a chance to see it, also."

Jay Apt said: "For all of us, it was a pretty profound experience to look up there and see the only other folks orbiting the planet, pretty close. I guess we were about 60 miles apart at the time. Just knowing that each spacecraft carrying its own world of oxygen and food was orbiting nearby and thinking to ourselves that that was pretty neat. And, there's probably never again going to be a time when men and women aren't continuously in orbit above our planet."

We asked Ken's crewmates how they felt about SAREX, and whether they would like to fly with it again.

Steve Nagel said: "Well, Ken was the 'primary ham,' as I called him. But I sure enjoyed the contacts I established. I had one where we talked to the students at Clear Lake here and I found that extremely enjoyable. I enjoyed having it on board. And Ken actually did manage the cables very well."

Linda Godwin said: "I think that all of us wish we had another day up there just to do more SAREX so we could have more time on the radio. I had one pass across Australia where I made some contacts, and one in New Zealand. It's kind of amazing that you're talking to the people down on the ground and you have a direct link with the folks down there you're seeing out through the windows. It's great."

Jerry Ross said, with a chuckle: "This was my first and ONLY two-way link on ham radio. So I have a very unique situation in the ham world."

Jay Apt said: "I felt privileged to be able to have direct contact with folks we were flying over. Jerry and I were talking one night about how neat it was to look down and think of all the cultures who were spread out below you and what those people were like, and I thought it was pretty neat to just have a way to talk to those people and learn about their cultures. I did talk to some folks in Australia and some folks in Hawaii, in addition to some of the school contacts we made. I think it's good for us to maintain some awareness that there's people on the ground different from you."

as Junior was about to complete his contact with the shuttle. SAREX control told us to ask our question and José and Jennifer McCarrick asked Ken questions about the Gamma Ray Observatory and how the body changes in space.

On the next day, when the astronauts woke up, they had several messages in their morning mail waiting for them in their TAGS (Text And Graphics System)—NASA's fancy term for a FAX machine. The SAREX sheet included "Thanks for going for the backup bridge on rev. 21. The kids at Reizenstein and Lyman were thrilled." That was an understatement!

All ten groups of U.S. schools were able to get through successfully during *Atlantis*'s flight. Unfortunately, everything didn't work as well as the school contacts. Several gremlins crawled into the system and the packet and slow-scan modes didn't work as well as predicted.

Packet and Slow-Scan TV

The packet and slow-scan television hardware is contained in the ROBOT box. The same box had flown with Tony England W0ORE on the Spacelab 2 mission in 1985 and was upgraded to add packet capabilities. Unfortunately, something happened between the last time the box was checked out on the ground and when the astronauts set it up in orbit, and the box would not work in its packet or slow-scan receive mode. Ground stations could hear the packet beacon and receive slow-scan pictures from the shuttle, but the astronauts couldn't receive slow-scan from the ground. The SAREX engineers thought that the problem was probably caused by a loose or broken cable and were anxious to get the hardware back so they could determine where the problem was and prevent it from happening again. *[Ed. Note: A broken* wire in one of the cables was indeed the culprit!]

The astronauts still had the capability to transmit slow-scan pictures and sent many images of the crew cabin as well as the EVA activities. In addition, they made the best of the situation by spending more of their time in voice mode than originally planned.

Shuttle–*Mir* Contact

The Soviet *Mir* spacecraft was in an orbit which repeated around the earth at a similar rate to *Atlantis*'s orbit. While the two spacecraft were in widely separated orbits, they did pass close to each other on many occasions. The biggest problem preventing a ship-to-ship contact was crew schedules—both crews have to be available at the same time. During the STS-35 mission, *Columbia*'s crew tried to contact *Mir*, but the visiting *Mir* crew had just completed a docking and were shutting down systems on the ferry *Soyuz* spacecraft.

The most important technical problem is not the obvious one, the Doppler shift, but the relative velocities between the spacecraft. Since the spacecraft are in different orbits, they could be several thousand kilometers apart at one point, and a minute later be within a couple of kilometers of each other, and then thousands of kilometers apart in another minute. Besides limiting contacts to relatively short conversations, the antenna's pointing angles can be critical as the spacecrafts move relative to each other.

The most obvious problem for communications, language, was actually a non-problem. Musa Manarov U2MIR speaks English quite well and is extremely popular with hams around the world. On the U.S. side, while he hadn't used it in a while, Ken Cameron had studied a couple of years of Russian in college.

On the first flight day, Ken tried unsuccessfully to QSO *Mir*. The crew tried many times and did, at one point, hear the *Mir* cosmonauts. Musa (operating U2MIR) later confirmed hearing the *Atlantis* as well. This contact was the very first time that astronauts aboard a U.S. spacecraft had contacted cosmonauts aboard a Soviet spacecraft directly. (During Apollo-Soyuz, all radio communications between the spacecrafts were via their own ground stations.) Curiously enough, one of the first confirmations that Musa had heard *Atlantis* came from Ron Parise WA4SIR (who operated SAREX onboard the previous STS-35 mission), after talking to *Mir* from the Soviet mission control center he was visiting at the time!

Live Video Uplink

STS-37 was also the first attempt to receive live television aboard a U.S. spacecraft. Since *Apollo 7* in 1968, U.S. astronauts have sent back thousands of hours of inflight video, but have never seen broadcasts from the ground. The only monitors aboard the shuttle are closed circuit displays to monitor the shuttle's systems and on-board video cameras. During the *Spacelab 2* STS-51F flight, the astronauts got to see still frames for first time—via SAREX's slow-scan receiver. Until STS-37, no live television (fast-scan) had ever been received aboard a U.S. spacecraft.

Andy Bachler N9AB, a member of the Motorola Amateur Radio Club in Schaumburg, Illinois, developed the SAREX side-window-mounted antenna, and the fast-scan video hardware. Besides Andy's station, the other video uplink sites were Kai Siwiak KE4PT in Motorola, Ft. Lauderdale; Jim Steffen KC6A in Long Beach, California; and the Amateur Radio Clubs located at NASA's Goddard Spaceflight Center WA3NAN in Greenbelt, Maryland (using the U.S. Naval Academy's 40′ dish in Annapolis), the Johnson Space Center W5RRR in Houston, Texas, and the Marshall Spaceflight Center WA4NZD in Huntsville, Alabama. The videos prepared for uplink included *Atlantis*'s launch, a videotape of the Gamma Ray Observatory's Payload Operations and Control Center at Goddard, and even an amateur video production.

During the first fast-scan uplink, *Atlantis* was not able to get a viewable picture, probably because of the orbiter's attitude. On the second and third attempts, the video uplink stations at Long Beach, Goddard, Marshall, and Schaumburg were able to uplink live video to the astronauts.

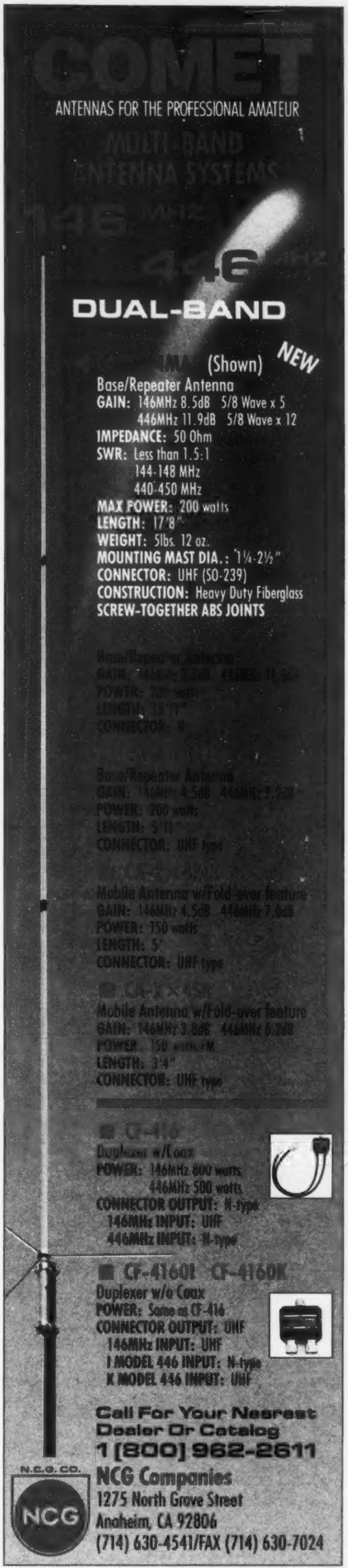
A Bonus Day

The deployment of the Gamma Ray Observatory and the spacewalk went fine, and *Atlantis*'s crew packed up their crew cabin to prepare for a landing on Wednesday April 10th. Unfortunately, the weather wasn't cooperating and the winds were too high. Flight controllers decided to keep the shuttle up for another day and wait for the weather to improve. There wasn't enough time to justify opening up most of the other experiments for just one more flight day, but the astronauts did take out the SAREX handheld transceiver and several cameras to take additional pictures of the earth. The bonus day resulted in *Atlantis*'s crew time being almost completely dedicated to amateur radio and unplanned QSOs! A couple of hams have kidded that SAREX got promoted from a secondary payload up to primary! Unfortunately for U.S. hams, the passes during that bonus day were primarily over South America and Africa. The next morning the crew was ready to come home again, and the weather cooperated. *Atlantis* landed at 6:55:29 AM PDT, 28 minutes short of a six day mission.

A Memorable Mission

During *Atlantis*'s 93 orbits, the five astronauts had talked with lots of hams and students around the world, received live video, and accomplished the first direct communications between a U.S. and a Soviet spacecraft. If they had only stayed up long enough for me to make a successful QSO (sigh)!

Contact Philip Chien KC4YER at 4340 S. Hopkins Ave. #40, Titusville FL 32780.



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446MHz 11.9dB 5/8 Wave x 12
IMPEDANCE: 50 Ohm
SWR: Less than 1.5:1
144-148 MHz
440-450 MHz
MAX POWER: 200 watts
LENGTH: 17'8"
WEIGHT: 5lbs. 12 oz.
MOUNTING MAST DIA.: 1¼-2½"
CONNECTOR: UHF (SO-239)
CONSTRUCTION: Heavy Duty Fiberglass
SCREW-TOGETHER ABS JOINTS

Base/Repeater Antenna
GAIN: 146MHz 8.2dB 446MHz 11.5dB
POWER: 200 watts
LENGTH: 15'11"
CONNECTOR: N

Base/Repeater Antenna
GAIN: 146MHz 4.5dB 446MHz 7.2dB
POWER: 200 watts
LENGTH: 5'11"
CONNECTOR: UHF type

Mobile Antenna w/Fold-over feature
GAIN: 146MHz 4.5dB 446MHz 7.0dB
POWER: 150 watts
LENGTH: 5'
CONNECTOR: UHF type

■ CA-2×4SR
Mobile Antenna w/Fold-over feature
GAIN: 146MHz 3.8dB 446MHz 6.2dB
POWER: 150 watts FM
LENGTH: 3'4"
CONNECTOR: UHF type

■ CF-416
Duplexer w/Coax
POWER: 146MHz 800 watts
446MHz 500 watts
CONNECTOR OUTPUT: N-type
146MHz INPUT: UHF
446MHz INPUT: N-type

■ CF-4160I CF-4160K
Duplexer w/o Coax
POWER: Same as CF-416
CONNECTOR OUTPUT: UHF
146MHz INPUT: UHF
I MODEL 446 INPUT: N-type
K MODEL 446 INPUT: UHF

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CIRCLE 54 ON READER SERVICE CARD

Software for the Ham Shack, Part III

Useful ham calculations you can program yourself!

by Bill Clarke WA4BLC

Another month has passed, and it's time for Part III in this series. By now you have become used to working with the formulas you added to the system last month. Using a computer for mathematical computations sure does make life easy.

Let's add a little more to the system. This month the MAIN MENU will grow to seven choices. Added will be:

6 - RADIO HORIZONS
7 - OHMS TO RESISTOR COLORS

Module Six

Figuring VHF/UHF ground waves is important when installing home and repeater antennas. The maximum usable distance for ground waves depends on the height of the antenna. This module asks for the antenna's height, then gives the maximum ground wave in miles. The figures are for flat terrain with the receiver at ground level.

Module Seven

Ever start a small project and list all the resistors you'll need, then have to stop and figure out the color codes? This handy module asks for the resistor value in ohms, then gives you the colors of the bands you will want to look for.

Entering the Listing

Before you add program lines from this month's listing, you must first LOAD "HAM2". After it's loaded, LIST it. Then you're ready to start typing. As before, don't worry if some of the lines appear out of order. The computer will straighten everything out.

Note modifications for the C-64 (see the listing).

After you have completed typing in all the lines, SAVE your work under the name HAM3.

Using the New Program

Load the new program by typing LOAD "HAM3" and pressing ENTER. When the computer signals READY on the screen, type RUN and press ENTER. This should be old hat by now.

The next thing you should see is the MAIN MENU for your new Ham System. It now shows seven selections: ANTENNA DESIGN MATH, TRANSMISSION LINE MATH, OHM'S LAW, POWER FORMULAS, EFFICIENCY FORMULA, RADIO

C-64 Modifications for HAM3

Don't forget about the modifications listed in Part 1 for C-64 users, and the following:

Replace the listed lines as follows:

```
610 INPUT "ANTENNA HEIGHT IN FT";H
616 PRINT "MAX HORIZ DISTANCE IS: "FNA(D)" MI"
731 PRINT "THE RESISTOR COLOR BANDS ARE:"
732 PRINT F$"/"S$"/"T$
```

Listing for HAM3

```
19 PRINT SPACE$(26);"6 - RADIO HORIZON"
20 PRINT SPACE$(26);"7 - OHMS TO RESISTOR COLORS"
37 IF M$ = "6" THEN 600
38 IF M$ = "7" THEN 700
600 CLEAR : CLS
601 PRINT SPACE$(26);"RADIO HORIZON"
602 PRINT SPACE$(20);"-----------------------------"
603 PRINT : PRINT : PRINT
610 INPUT "THE HEIGHT OF YOUR VHF/UHF ANTENNA IN FEET";H
611 A = 3*1.33*H
612 B = A/2
613 D = SQR(B)
614 GOSUB 390
615 PRINT : PRINT
616 PRINT "MAXIMUM HORIZONTAL DISTANCE IS: "FNA(D)" MILES"
620 PRINT
621 PRINT "N - TRY AGAIN"
622 PRINT "M - MAIN MENU"
623 M$ = INKEY$
624 IF M$ = "N" THEN 600
625 IF M$ = "M" THEN 10
626 GOTO 623
700 CLEAR : CLS
701 PRINT SPACE$(25);"RESISTOR COLOR CODES"
702 PRINT SPACE$(20);"-----------------------------"
703 PRINT : PRINT : PRINT
710 INPUT "THE RESISTANCE YOU WANT IN OHMS";R$
711 A$ = LEFT$(R$,1)
712 B$ = MID$(R$,2,1)
713 X$ = A$
714 GOSUB 751
715 F$ = C$
716 X$ = B$
717 GOSUB 751
718 S$ = C$
719 C = LEN(R$)
720 T = C-2
721 GOSUB 771
722 T$ = M$
```

Program listing.

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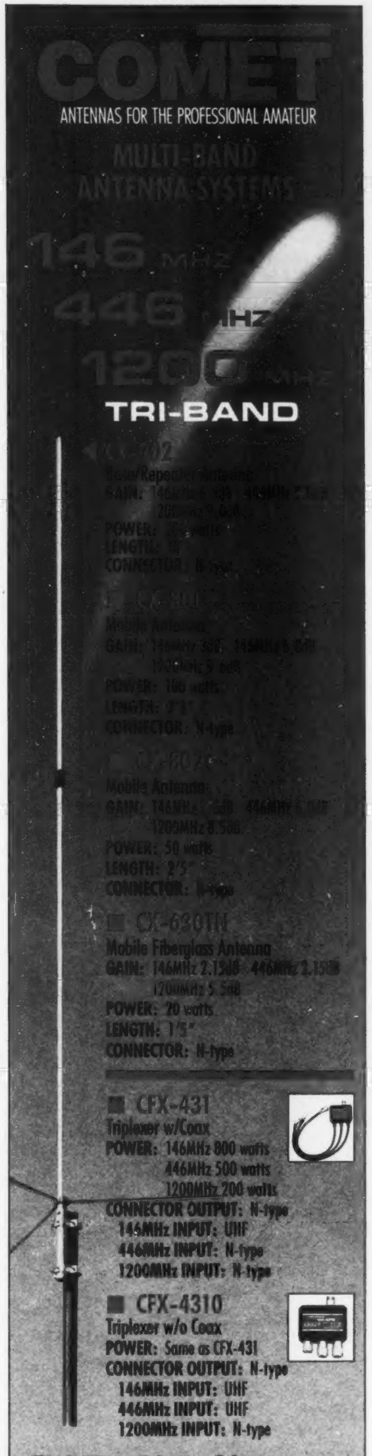
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MULTI-BAND ANTENNA SYSTEMS
146 MHz
446 MHz
1200 MHz
TRI-BAND

[illegible]
Base/Repeater Antenna
GAIN: [illegible]
POWER: [illegible] watts
LENGTH: [illegible]
CONNECTOR: N-type

[illegible]
Mobile Antenna
GAIN: 146MHz 3dB 446MHz 5.6dB
1200MHz 9.6dB
POWER: 100 watts
LENGTH: [illegible]
CONNECTOR: N-type

[illegible]
Mobile Antenna
GAIN: 146MHz [illegible] 446MHz 6.0dB
1200MHz 8.5dB
POWER: 50 watts
LENGTH: 2'5"
CONNECTOR: N-type

■ CX-630TN
Mobile Fiberglass Antenna
GAIN: 146MHz 2.15dB 446MHz 2.15dB
1200MHz 5.5dB
POWER: 20 watts
LENGTH: 1'5"
CONNECTOR: N-type

■ CFX-431
Triplexer w/Coax
POWER: 146MHz 800 watts
446MHz 500 watts
1200MHz 200 watts
CONNECTOR OUTPUT: N-type
146MHz INPUT: UHF
446MHz INPUT: N-type
1200MHz INPUT: N-type

■ CFX-4310
Triplexer w/o Coax
POWER: Same as CFX-431
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1200MHz INPUT: N-type

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CIRCLE 54 ON READER SERVICE CARD

The Megaloop

Continued from page 30

and it might be expected that much of the electromagnetic field would radiate off along this part of the loop before reaching the parts running north-south. See Figure 5. I tried testing this directional effect, favoring east and west on 10 and 15 meters, but I didn't get any conclusive results.

The primary effect I was looking for was the diversity in the presence of multipath fading. This I did indeed observe, especially on the higher bands. But I wasn't surprised. Contacted stations reported less fading from my signal on the megaloop, compared to the verticals. I have experienced this advantage of geographically large antennas in the past, with the 880-foot long wire that I put up, and also with various kite-supported sloping longwires.

So what's the great advantage of a megaloop? For me, it was a chance to satisfy my megalomania, to do something before the real estate was no longer available. It was a temporary, wintertime antenna, and I'm glad my parents let me do all this experimenting there. I took the antenna down as soon as I had established that it worked; I didn't want this huge lightning attractor giving my mother anxiety all summer long. Now all that wire sits in the basement, awaiting some other grand project such as the 3/4 mile kite sloper . . . maybe. 73

You may write Stan Gibilisco W1GV at 871 S. Cleveland Avenue #12, St. Paul MN 55116. Please include an SASE for a reply.

Software for the Ham Shack

Continued from page 42

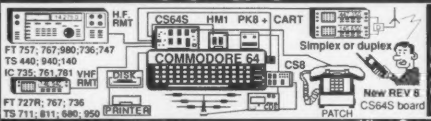
```
723 IF T$ = "" THEN 790
730 PRINT : PRINT : PRINT
731 PRINT "THE RESISTOR COLOR BANDS ARE: " F$"/ "S$"/ "T$
732 PRINT
740 PRINT "N - TRY AGAIN"
741 PRINT "M - MAIN MENU"
742 M$ = INKEY$
743 IF M$ = "N" THEN 700
744 IF M$ = "M" THEN 10
745 GOTO 742
751 IF X$ = "0" THEN C$ = "BLACK"
752 IF X$ = "1" THEN C$ = "BROWN"
753 IF X$ = "2" THEN C$ = "RED"
754 IF X$ = "3" THEN C$ = "ORANGE"
755 IF X$ = "4" THEN C$ = "YELLOW"
756 IF X$ = "5" THEN C$ = "GREEN"
757 IF X$ = "6" THEN C$ = "BLUE"
758 IF X$ = "7" THEN C$ = "VIOLET"
759 IF X$ = "8" THEN C$ = "GRAY"
760 IF X$ = "9" THEN C$ = "WHITE"
761 RETURN
771 IF T = 0 THEN M$ = "BLACK"
772 IF T = 1 THEN M$ = "BROWN"
773 IF T = 2 THEN M$ = "RED"
774 IF T = 3 THEN M$ = "ORANGE"
775 IF T = 4 THEN M$ = "YELLOW"
776 IF T = 5 THEN M$ = "GREEN"
777 IF T = 6 THEN M$ = "BLUE"
778 IF T = 7 THEN M$ = "VIOLET"
779 RETURN
790 PRINT : PRINT
791 PRINT "CANNOT PROCESS VALUE LESS THAN 10 OHMS"
792 GOTO 732
```

Program Listing

HORIZON, and OHMS TO RESISTOR COLORS.

Next month, in Part IV, you'll add the last two modules of Ham System to your software. See you then! 73

You may write Bill Clarke WA4BLC at RD#2 Box 455-A, Altamont NY 12009. Please include an SASE in you request information.



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Ultra Com Shack 64 Manual all schematics, diagrams, how to operate& set up remote base. Refund with purchase of CS64S MN.$25.00

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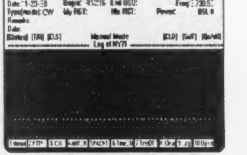

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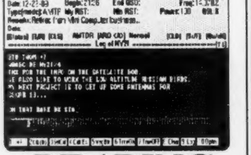

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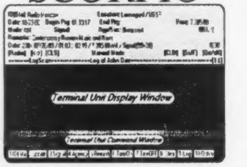

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RF005

73 Review

by Dick Goodman WA3USG

SSTV with the Robot 1200C Scan Converter and the Martin Emmerson EPROM Version 4.0

Martin Emmerson G3OQD
6 Mount Hurst Rd.
Hayes, Bromley
Kent, England
Tel. (011) 44-81-462-4223
Price Class: EPROM Version 4.0, $140;
Crystal Oscillator Board, $60.
Cashier's check; Call or write for exact pricing.

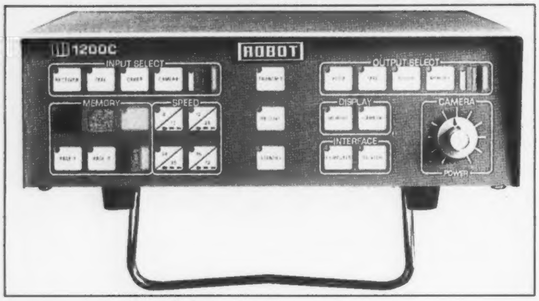

Photo A. The Robot 1200C scan converter.

Slow-scan television (SSTV) has evolved slowly but steadily in the last several years. Various transmission and reception standards have come and gone. Several companies have produced SSTV equipment and then disappeared from the scene. One company has been a mainstay in the field of SSTV: Robot Research of San Diego, California, manufacturer of the Robot 1200C scan converter (Photo A). While Robot's "bread and butter" is no longer in the amateur field, they still periodically schedule production runs of the 1200C.

Approximately three years ago, Ben Blish N4EJI (now AA7AS) created an SSTV system called the "Black Belt System," based on the Amiga 500/2000 computer. The Amiga Video Terminal (AVT) contains all current modes of SSTV, including those of Robot. It also includes its own special AVT protocol that proved superior to Robot. The complete AVT system is presently being marketed by AEA and is an excellent way to enter the wonderful world of SSTV. As new standards and protocols are developed, they may be easily incorporated into the AVT software.

There are other SSTV systems available. Research and development by other companies is moving at a dynamic pace, but at this time Robot and the AVT system are neck and neck in the forefront of SSTV technology. If there is an advantage of one system over the other, I would say it is in the field of marketing. The AVT system is being sold by AEA and other dealers. It has national advertising and support. Pick up a copy of virtually any amateur radio magazine and the AVT system will be advertised. Robot Research has limited exposure. The Robot 1200C is currently available from PC Electronics in Arcadia, California. Robot Research will also take orders directly at the factory.

With the impressive capability of the AVT system, its national exposure, and the ease of updates to the software, I felt that it was going to rapidly become the dominant SSTV format. Then Martin Emmerson G3OQD of Bromley, Kent, England, developed an updated EPROM for the Robot 1200C that incorporated virtually all existing SSTV modes including those used in the AVT system.

Robot 1200C Basics

The Robot 1200C scan converter is a complete, stand-alone SSTV system that requires only a video camera, radio transceiver, and television set (or video monitor) for operation. It does not require a computer. With these items, full color, high resolution pictures may be sent and received from virtually anywhere in the world.

Unfortunately, Robot decided not to support anything other than Robot modes of SSTV. This caused few problems when only Robot SSTV systems were available, but as time passed other systems were developed. An example of this is the Volker-Wrasse system used by European and other DX stations. This was incompatible with any Robot SSTV system, including the 1200C.

Even with these shortcomings, the Robot 1200C survived. While not as sophisticated as the AVT system, the Robot 1200C required very little additional equipment for its operation. It also contained a video digitizer that allowed grabbing full color frames from any video source. These frames may be stored in the Robot's internal memory and displayed on any television. The picture may also be transmitted, via the connected radio transceiver, anywhere that voice contact is possible. That's pretty impressive for a box about 11" x 4" x 12". The AVT system needs an Amiga computer along with the AVT SSTV hardware and software. If pictures from a video camera are to be sent, you must also get a video digitizer board and install it in the Amiga.

What makes the Robot 1200C incompatible with other SSTV systems is the program stored in its internal EPROM. But, this program could be rewritten to add other SSTV protocols, stored on a new EPROM, and put in place of the original Robot EPROM.

Modernizing the Robot 1200

The Martin Emmerson EPROM Version 4.0 (Photo B) contains all existing Robot modes

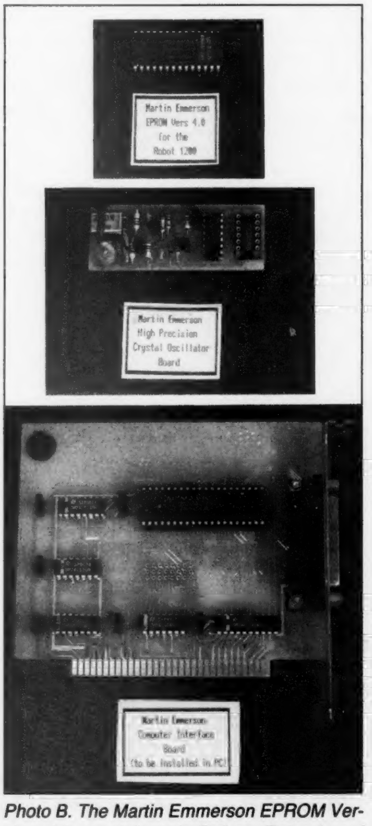

Photo B. The Martin Emmerson EPROM Version 4.0, crystal controlled oscillator board and the optional parallel port board for the IBM PC.

and virtually all current SSTV formats used anywhere in the world! Its additional features may be controlled from the front panel of the Robot 1200C, or operated remotely with enhanced features via computer control. It should be stressed, however, that a computer is *not* necessary to use any of the new SSTV modes.

To take advantage of all the features of the new EPROM, the Robot 1200C must be modified. The procedure is not difficult but, as with all Robot-related modifications, documentation is difficult to come by.

The procedure is basically threefold. First, unplug the original Robot EPROM and plug in the new Version 4.0 EPROM in its place. Second, install a crystal-controlled oscillator board (see Photo B). This involves removing a chip from the Robot, plugging the oscillator board into the empty socket, and placing the removed chip in a socket provided on the oscillator board. Third, replace all 64K memory chips in the Robot with 256K RAM ICs. This last modification also involves soldering a series of jumper wires to the Robot's motherboard, changing a jumper pin, and replacing an IC. Depending on the production run of the Robot, the IC may have to be unsoldered. The entire modification took me about two hours (I had to unsolder the IC).

Once the modification is complete, the Robot has the capability to store four high resolution color pictures in its internal memory (instead of one picture). This memory can also be used by Robot control programs (with an IBM compatible computer) for truly spectacular capabilities and special effects. More about this later.

The Emmerson EPROM

I ordered the Martin Emmerson EPROM directly from Mr. Emmerson in England. It took about six weeks to arrive as it was just coming out of beta testing. The EPROM is customized with your callsign, so it can be used only by the owner. It is apparent that Mr. Emmerson put quite a bit of effort into the development of the program on this EPROM. This "customizing" will prevent users from copying the EPROM and passing it on (unless you want others on the air displaying your callsign). I feel that the price for this chip is in line with what it will do.

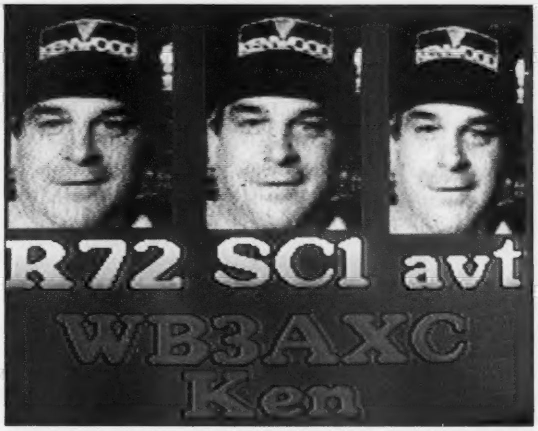

Photo C. Comparisons of Robot 72-second, Scottie SC1 and AVT 94-second pictures as received over a noisy UHF FM path. (This display and labelling was done with the Hi-Res 1.4 control program.)

Photo D. SSTV reception from Jim K4TGC on 14.233 MHz, using 36-second Robot protocol.

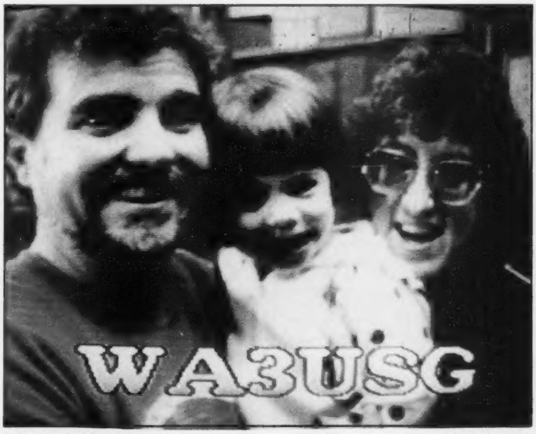

Photo E. WA3USG's family, transmitted on 2 meters and relayed back over a 35-mile path.

I also ordered the crystal oscillator board from Mr. Emmerson. The EPROM and oscillator board arrived intact from England, packaged ruggedly for shipment. The documentation provided is adequate. It consists of 12 high quality typewritten pages and several diagrams. Installation instructions are reasonably clear. If you have any questions, get on 14.230 or 14.233 MHz and holler for help. I can almost guarantee that during virtually any waking hour, there will be someone on frequency who has performed this modification! Instructions are also provided for replacing the 64K RAM with 256K chips.

What will the Martin Emmerson Version 4.0 EPROM do, once it is installed and all modifications are complete? All Robot modes are left completely intact and functional, and you will have many new ones. The four Scottie (SC-1) modes are used by many DX stations and US stations. It is not unusual to hear stations exchanging pictures, using the Scottie modes for hours at a time. It is interesting to compare the Robot modes with that of Scottie. In almost every instance, a picture received will look noticeably better when received via the Scottie mode, as opposed to the Robot protocol.

There are also the Martin and Wraase modes. These are used primarily by DX stations and are not as popular as Scottie.

Finally, there are the AVT modes. Two are provided: the 94-second and the 188-second. Each of these modes has a QRM and narrow bandwidth toggle (as does the actual AVT system). Pictures sent and received in the AVT modes are, in my opinion, the best of all protocols! Noise and QRM affect the received picture much less noticeably than in the other modes.

While difficult to objectively quantify, I ran some experiments on a UHF path of about 35 miles. I used frequency modulation, and carefully controlled signal levels to yield approximately 50% quieting. The S-meter was constantly observed to assure compliance to a controlled standard. Ken Starck WB3AXC, using a Robot 1200C, digitized a picture of himself and sent it in Robot 72-second color, Scottie SC1, and AVT 94-second. Each picture was saved in one of the four internal Robot memories. Photo C shows the results of this experiment. The difference between these modes on HF using SSB are even more dramatic. Documenting and recording these differences is difficult, however, as conditions on HF change drastically from one moment to the next.

The Results

Perhaps the best thing about the Martin Emmerson EPROM is that it makes the Robot 100% compatible with virtually any SSTV standard in existence. The picture quality in any of these modes can be very good indeed. Photo D shows a picture received on 14.230 MHz from Jim K4TGC in Pulaski, Tennessee, using 36-second Robot protocol. Conditions were good and there was very little interference. Photo E is a relayed picture of my family that I transmitted to another station on 2 meters. The other station, located about 35 miles away, stored my picture in the Robot's internal memory and sent it back.

The Robot 1200C with the Martin Emmerson EPROM really shines when used under the control of an IBM compatible computer and proper Robot control software. The Robot 1200C has a rear-mounted parallel port, using a DB-25 connector, that may be interfaced with a PC clone.

To take advantage of this feature, a special parallel interface board must be installed in your computer (Photo B). I purchased mine from Martin Emmerson, but as of this writing others may be available that will work equally well. *[Ed. Note: Another appropriate parallel interface board is the PIO-12 made by Keithley Metrabyte Corporation, 440 Myles Standish Blvd., Taunton MA 02780. Phone: (508) 880–3000.]*. Inquiring on 14.230 MHz will also yield information on other possible manufacturers. A cable connects the interface board in the computer to the Robot rear parallel connector.

There are several excellent Robot control programs on the market that are a subject in themselves. Basically, these programs allow the operator to enhance the operation of the Robot 1200C. Pictures saved in Robot memory may be manipulated, changed in size, and cut and pasted with other pictures. Pictures may also be saved as disk files for permanent storage and recall. Hits in the picture as a result of noise or fades may be eliminated or minimized.

Special test patterns and graphics may be called up and displayed and transmitted. The picture shown in Photo C was composed with a PC and a Robot control program called "Hi-Res, Version 1.4" by Tom Jenkins N9AMR. The Robot may also be commanded into transmit or receive, SSTV modes changed, and video inputs/outputs selected. Other popular control programs are SCAN (written by Bert Beyt W5ZR), SSTV (originally written by Jim Williams KC5VC, modified by G4UKL and now offered by Garnet "Beb" Bebermeyer WB0UNB) and IMAGE (offered by Dick Isely WD9GIG). These control programs offer different features and really expand the capabilities of the Robot 1200C.

In summary, the Robot 1200C is the only true stand-alone SSTV system available. With it, a video camera, and a transceiver, you have a complete SSTV system. All that is required is a connection to the receiver's audio, transmitter audio in, and video in from any video camera. A conventional color TV or video monitor will display the captured pictures.

The Robot 1200C is capable of capturing full color video frames from any NTSC color camera, such as a camcorder. It will also function well with monochrome cameras. It is possible, using red, blue, and green filters, to store and send full color pictures using only a monochrome camera. With the modifications described, it will hold up to four high resolution color images in its internal memory. These may be images received off the air, or images captured from your camera. It will store up to 12 low resolution images, such as eight-second black-and-white pictures. All SSTV modes may be selected from the front panel without a computer. The addition of the Martin Emmerson EPROM Version 4.0 has updated the Robot 1200C to a state-of-the-art SSTV system, second to none.

I would be happy to answer any questions in reference to the EPROM Version 4.0 or the Robot 1200C. I hope to hear some new voices on 14.230 or 14.233 MHz. SSTV takes place daily on these frequencies. Drop on by and give a call, someone will be there to help you. ■

Computer control options for the Robot 1200C

Hardware		
Parallel Board (for IBM PC control of the Robot)	Martin Emmerson Board (see address above) 75 English pounds, or equivalent	
Miscellaneous	256K memory chips @ $4 each, 18 required (various sources).	
SSTV Software (Robot 1200 control programs for the IBM PC or clone)		
Hi-Res, Version 1.4	$75	Tom Jenkins N9AMR, 5968 S. Keystone Ave., Indianapolis IN 46227. (317) 784–6118
SCAN, Version 6.0	$20	Bert Beyt W5ZR, 301 Tampico St., New Iberia LA 70560
SSTV	$20	Garnet Bebermeyer WB0UNB, 15 Almeda Ct., Fenton MO 63026. (314) 343–8122.
IMAGE	$27	Dick Isely WD9GIG, 736 Fellow St., St. Charles IL 60174.

Contact Dick Goodman WA3USG at 199 Maple Lane, Mechanicsburg PA 17055. Please send an SASE for any information you request.

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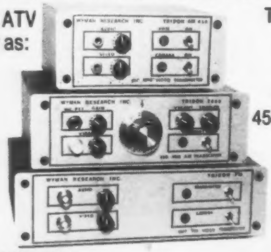

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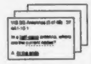

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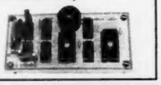

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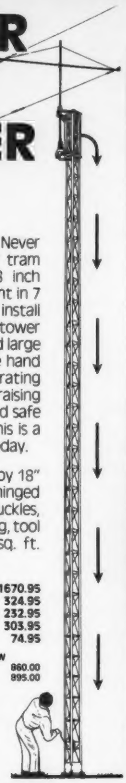

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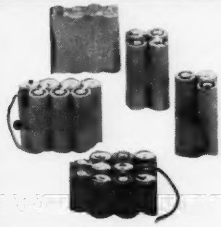

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CIRCLE 191 ON READER SERVICE CARD

Number 13 on your Feedback card

73 Review

by Dave Pelaez AH2AR/8

The ATV-3 Downconverter

Tune in to ATV with this economical kit.

Communication Concepts Inc.
508 Millstone Dr.
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(513) 426-8600
Price Class: Kit, $50; Assembled, $70.

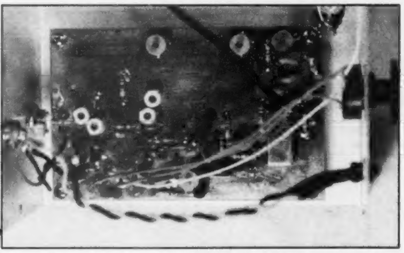

Photo. The completed ATV-3 downconverter kit mounted in a case.

It's becoming more difficult to find companies willing to cater to the kit builder, but there are a few brave souls out there who have continued to supply project kits to those folks hopelessly addicted to rosin smoke. One of those companies is Communication Concepts, Inc., which has supplied many different types of linear amplifier and ATV-related kits to hobbyists for many years. Their ATV-3 GaAsFET Downconverter is a relatively new kit that has not received much fanfare.

The ATV-3 hooks up between your TV set and a good 70 cm antenna. With the ATV-3 in-line you can tune the entire 70 cm ATV band and convert it down to channel 3 or 4 on your TV. Although the converter tunes from 420–450 MHz, the commonly used ATV frequencies are 439.25, 434, 427.25, 426.25 and 421.25 MHz.

I discovered the ATV-3 after scouring the countryside for a reproducible kit for a group kit building session at our radio club. After putting together the kit from CCI, I was satisfied that it perfectly suited the requirements I had established for our kit building session: The quality of the double-sided printed circuit board and components is superb, and, most importantly, the sensitivity and performance of the finished product was much better than I expected!

Let's break out the magnifying glass and take a closer look at this kit.

Assembly

The total construction time ended up being about two hours. Due to the complexity of mounting several components, a beginner kit builder might want to get some help from someone a little more experienced in mounting the four surface mount capacitors and the two small toroidal inductors. Most of the other 52 components would not really pose a construction problem to a beginner. By following the step-by-step assembly instructions, and referring to the illustration, proper component placement is a breeze.

After helping to assemble 25 other circuit boards, I have cataloged a few possible "problem areas" that may be a concern to the novice kit builder. I talked with Roger Southworth, owner of CCI, and he plans to incorporate some of these suggestions in the next edition of the construction guide. Here, briefly, are my construction tips:

- The #30 gauge wire supplied for the 15-turn toroid inductor is the supplied red wire, and the #24 gauge wire for the 5-turn/3-turn toroid inductor is green.
- Q4, an MPSH-81 transistor, should be mounted as close to the printed circuit board as possible. Mounting this transistor at the prescribed height of ¼" may cause the transistor to "ring." It could also create a self-oscillation, causing a raster-type blank screen image to appear within the passband of a received ATV signal.
- Before soldering them on the circuit board, cut the leads short on the supplied MRF 966 and the MRF 901. This will make it easier to install the other components once the transistors have been soldered in place.
- The varicap diode, MV2205, is actually an MV2105. This will be corrected in the next printing of the instruction guide. In mounting the varicap diode, make sure that the flat part of the TO-92 case goes against the trimmer capacitor, C-23.
- The two "hairpin" type inductors are not drawn to scale. Be sure to follow the directions and make them 0.4" high off the printed circuit board. Their width can be governed by the pre-drilled holes in the printed circuit board.
- Keep all lead lengths as short as possible, including the lead lengths of the exposed center conductor of the 50 ohm transmission line.
- You might want to opt for purchasing a panel-mounted potentiometer. That way you can change ATV frequencies once you have mounted this circuit in a shielded enclosure.
- The "double balanced mixer," a rectangular can with eight pins, can be installed improperly if you're not careful. Once it is soldered in place, it would be almost impossible to remove it if you installed it backwards. There is a blue-colored alignment pin which is mentioned in the instructions. Follow these instructions carefully to ensure proper installation.

Alignment and Testing

If you have assembled the kit properly, a "smoke test" will certify your expert kit building techniques. The alignment process can be as important as making sure that the kit was assembled properly. If the kit falls off on performance, you can be almost certain that the kit has not been properly aligned. If you do not have a service monitor, it is absolutely imperative that you have a friend transmit an alignment signal on 70cm ATV. Do not attempt to align the downconverter with an ATV transmitter located in the next room—overloading the downconverter with a transmitter two feet away will make the alignment process frustrating, if not impossible.

Roger's suggestion of starting off with a commercial UHF signal as a means of rough alignment is helpful. Once you have found a commercial UHF signal and you step through the alignment procedures, ask a friend who has an ATV transmitter to supply an alignment signal (which is an order of magnitude weaker than a commercial station) for your final tweaking. If the transmitted signal is located a few miles away from your downconverter, this will help you in ensuring that the system is properly aligned and the downconverter is not being swamped.

By tuning capacitor C5, any commercial UHF television images can be effectively notched out. This adjustment may not be readily apparent, since C5 has literally no effect on the received 70cm signal. If images appear within the ATV range of the downconverter tuning potentiometer, this is the first setting to check in order to properly notch out these MEGA-ERP power television signals.

How Does It Work?

Out of the approximately 25 different hams who participated in the Dayton Amateur Radio Association kit building session, there wasn't a single dissatisfied customer. On-the-air tests with another commmercially available GaAsFET downconverter showed a slight edge when compared with the ATV-3 (weak signal reception). I couldn't see any detectable difference on stronger local signals. Even though I'm near several large commercial TV stations, the ATV-3 performs well with little interference from these stations.

This kit allows you to enjoy the best of both worlds . . . the chance to burn your fingers on the ol' soldering iron *AND* the satisfaction of constructing an extremely high-quality circuit.

Other Comments

This kit does not come with an enclosure or AC adapter. For the kit builders, I came up with a number of local sources for the hardware and chassis that we ultimately used for this project. For the type and size of enclosure you choose for your downconverter, you are limited only by your imagination. A simple power supply can be fabricated with a handful of junk box parts, or a visit to your local Radio Shack.

With kits still available from folks like Communication Concepts, the revered and esoteric art of electronic kit construction will remain alive and well . . . for those who love the smell of burning rosin flux in the morning!

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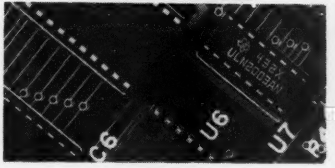

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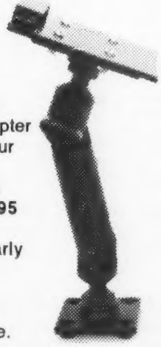

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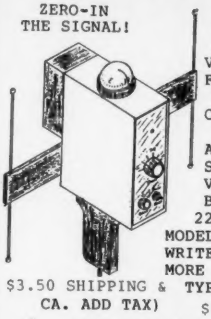

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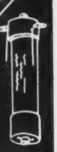

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A Mission of Firsts

The Shuttle Amateur Radio Experiment (SAREX) on the STS-37 *Atlantis* mission was a success, in spite of a broken wire precluding two-way packet and slow-scan television (SSTV) contacts with the crew. SAREX is a joint effort of NASA, the ARRL, AMSAT and the Johnson Space Center Amateur Radio Club.

On April 5 of this year, the first all-ham crew went to orbit with the Gamma-Ray Observatory (GRO), experimental "scooters" to be evaluated for future space-station use, and the most ambitious SAREX experiment to date. Amateur radio has two reasons to be included on shuttle flights. The first is to encourage public participation in the space program, and the second is to support educational opportunities derived from the voice and digital communications from space.

The crew included pilot Ken Cameron KB5AWP, commander Steve Nagel N5RAW, mission specialist Jerry Ross N5SCW, mission specialist Linda Godwin N5RAX, and mission specialist Jay Apt N5QWL. Ken, licensed since 1984 before coming to NASA, brought an enthusiasm to the SAREX program that was quickly shared by the other members of the STS-37 mission. Starting with Jay, the crew members took and passed their Technician-class tests. Linda became the first female ham in space.

Equipment Configuration

The ham gear on the *Atlantis* for STS-37 included an impressive array of equipment, such as a Motorola 2 meter hand-held transceiver, video and audio recorders, headset, color camera and monitor, fast-scan TV (FSTV) module, slow-scan TV (SSTV) scan converter, computer with tracking and packet software, packet module, window-mounted antenna system, and all the necessary cables to connect it together.

Amateur FSTV had never before been tried in space. This was a first, and it worked. The receive converter used by the crew measured only a few inches on a side. It connected to a Panasonic display and recorder unit, and to a small L-shaped antenna that was a part of the 2 meter loop antenna mounted with Velcro in one of the shuttle's flight-deck windows.

Some of the items in the equipment list had not been previously qualified for use on the shuttle. The Panasonic portable TV/VCR was one example. It resembles a lap-top computer with a flip-up video display and a VCR where a computer's keyboard would reside. The case is plastic, and considered inflammable. To qualify for flight, it was coated with a special foil and painted. The liquid-crystal display was tested to ensure that it would not shatter or come apart when hit with weights dropped from specific heights. It passed, and will likely be used on future flights.

The shuttle's ham antenna system acts like an outside-mounted quarter-wave whip, even though it is a shielded loop installed inside the shuttle. As with a whip antenna mounted on a large vehicle, there are signal nulls to contend with. If an automobile were placed in orbit with a roof-mounted antenna, reception from stations "under" the car would be poor. This occurs often with the shuttle whose orientation, with respect to stations on the earth, is constantly changing.

The packet system used on STS-37 was the same as that on the STS-35 flight. Several stations heard the beacon transmissions on 145.51 MHz from the *Atlantis*, but due to the broken wire in the cable between the scan converter and the radio, no audio from the radio got to the other equipment. Lou McFaddin W5DID inspected the cable after the mission, found the problem, and began repairs. The connection behind the plug to the scan converter apparently was flexed one too many times. The assembly will be potted and stiffened before it is used again, even though it had worked without problems on the previous flight and during many tests.

Photo A. STS-37 Atlantis *heads for space with an all-ham crew.*

SAREX
The Shuttle Amateur Radio Experiment
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Photo B. Gil Carman WA5NOM and students from the Clear Lake Independent School District communicate with the astronauts of STS-37.

The SSTV system also suffered from the broken wire, but even though pictures could not be uplinked to the shuttle via slow-scan, they could be sent to the ground. Many hams monitored the pictures sent from the shuttle via the heavily-modified ROBOT scan converter and 2 meter transceiver. On the third day of the mission, Ken KB5AWP configured the system to send "frame-grabbed" pictures of the extra-vehicular activity (EVA) of Jay N5QWL and Jerry N5SCW working on the GRO high-gain antenna.

Space-Bound "Real" TV

Earth-to-space frequencies on 70 cm are limited to only 3 MHz. For the flight of STS-37, several stations were given permission by the FCC to send normal (at least 6 MHz wide) TV to the shuttle. Jim Steffen KC6A was the first to have his transmission received on the shuttle. While SSTV had been used for uplink experiments years ago on a shuttle mission with Tony England W0ORE, this was the first time for wideband fast-scan TV. With 14 kW effective radiated power, Jim's pictures came through very well throughout most of the pass.

Andy Bachler N9AB sent a video of the shuttle's launch up to space allowing the crew to see their own liftoff via the Amateur FSTV link while still in orbit. This was another first. Others, including the Marshall Amateur Radio Club (WA4NZD) and the Goddard Space Flight Center Amateur Radio Club (WA3NAN transmitting via a 40 foot dish at the US Naval Academy at Annapolis, Maryland, manned by Bob WB4APR), successfully sent video to the shuttle. For terrestrial ATV activity, large antennas are used on both ends of long-distance contacts. With only the equivalent of a small whip antenna on the shuttle, the sending station on the ground needed to overcome the limitations of the shuttle's antenna as well as the distance penalty. Antennas planned for the space station later this decade should be better.

Continued on page 75

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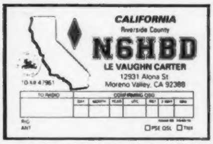
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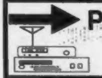

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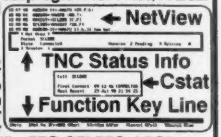

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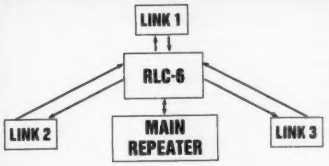

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HOMING IN

Radio Direction Finding

Joe Moell PE K0OV
P.O. Box 2508
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Three-Second T-Hunts

Remember those spy movies and TV shows where the good guys hide a transmitter on the bad guys' car and tail them to their hideaway? The best tracking gizmos featured a little screen with a moving map on it. The car with the crooks (or enemy agents, or whatever) would appear as a blinking dot on the hero's map screen.

I'm sure that back then these stories helped fuel the paranoia of people who were positive that their every move was being monitored by trench-coat-wearing agents in panel trucks. But we T-hunters knew it couldn't be done that easily. Ordinary Radio Direction Finding (RDF) sets "display only incoming signal azimuth," plus a rough idea of distance. No single tracking device can pinpoint a vehicle down to within a few feet. Multiple-station triangulation normally is not precise enough either, because small angular bearing variations from any station cause significant triangulation error.

Well, it's not science fiction anymore. Welcome to the nineties, and what promises to be the decade of super-accurate Automatic Vehicle Monitoring (AVM). International Teletrac Systems is the first to bring AVM to market, starting in Los Angeles. The network is in place, dealers are ready, and ads are appearing on TV.

A minor media war is going on between Teletrac and LoJack (see "Homing In," May 1991) for the stolen vehicle recovery market. Their technologies have major differences. VHF/UHF AVM systems like Teletrac use no directional arrays, loops, or beams. There are no Doppler homing units. Instead, AVM uses a wide-aperture, time-difference-of-arrival (TDOA) system.

Previous "Homing In" columns (September and November 1989) have described TDOA transmitter hunting techniques for hams, but they have all used narrow aperture (less than one-half wavelength) antenna spacing. AVM antenna spacings are measured in miles instead of inches.

Teletrac Versus Thieves

For a fixed price plus a monthly service fee, a Teletrac contractor will install a chalkboard-eraser-sized AVM transponder in an inconspicuous spot in your car. These transponders, called Vehicle Locator Units (VLUs), are manufactured under license by several Japanese firms.

The VLU contains logic to detect startup by an unauthorized person. It taps into the key warning buzzer circuit and other available signals. If a thief starts the car without a key, or trips any other alarm devices on the car, the VLU transmits its "I'm being stolen" digital message and an ID number to Teletrac's control center computer. The computer immediately issues a "location request" to start the RDF process.

Receiving a location request transmission makes the VLU switch from the "alert" channel to one of the many "location" channels and send out a transmission burst. All receiver sites listen for the burst and pass along what they hear (time of signal, the strength, and ID) to the control computer. The computer selects the four strongest site signals and looks at the differences in their time of arrival. Using an advanced RDF technique called multilateration, it locates the source of the signal.

About three seconds after the request transmission, the number crunching is completed and the computer displays the location of the vehicle as a mark on a computer-generated map (see Photo A). Accuracy is typically within 100 feet. As the thief drives away, the system issues more location requests and calculates the speed and direction.

After notifying the owner and/or authorities as appropriate, Teletrac operators continue to follow the stolen car. They update law enforcement agencies by phone, or send computer data to police/sheriff computer screens. All the while, the computer is recording the path on disk for possible court use as evidence. If another crime is committed en route, this record becomes even more important.

Note that none of the receiver sites have directional antennas or any other way to independently determine the direction of incoming signals. Direction of arrival at each site is unimportant; only the relative times of arrival are required to locate the transmission.

Even with antennas spaced many miles apart, time of arrival differences are measured in nanoseconds (billionths of a second). This means that the transmissions must be very short to ensure RDF accuracy. It takes precise timing and a fast computer. The first of the four receivers is used as a time reference and the other three sites give relative time information.

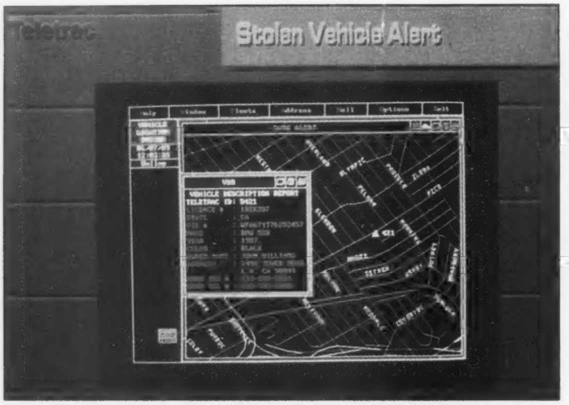

Photo A. Teletrac claims 100-foot accuracy with its vehicle location system.

Teletrac to Hams: Stay Off 70% of 33 Centimeters

The advent of AVM directly affects amateur radio, because it is taking place in our 902 to 928 MHz ham band. From the time hams first received a 33cm allocation, it has always been on a shared basis. The FCC established the priorities as follows:

1. Military radiolocation
2. Industrial/Scientific/Medical (ISM)
3. Government
4. Automatic Vehicle Monitoring
5. Amateur Radio
6. Low-power (Part 15) devices

Hams must not cause interference to the military, government, and AVM.

They must accept any QRM received from military, ISM, government, and AVM on this band. (ISM is a transmit-only service.)

Two years ago, Southern California hams were beginning to discover the usefulness of 902 to 928 MHz. A few repeaters and links were being tested, an ATV network was already working, and advanced experimenters were trying wideband high-speed digital message forwarding. Then Pacific Telesis announced the start of AVM testing. At a meeting between Pac-Tel and the Southern California Repeater and Remote Base Association technical committee (SCRRBA) in January 1990, Pac-Tel made it clear that interference from hams would adversely affect its Teletrac network.

As a result, the SCRRBA suspended all coordination on the 33cm AVM segments, and wrote a new band plan. In the new plan, weak signal work and repeater inputs are placed from 902 to 903 MHz. Amateur links and repeater transmitters on mountaintops and at other communications sites are being coordinated from 927 to 928 MHz, adjacent to the high power paging transmitters that are proliferating above 928 MHz. Putting weak signal ham operations at the low end of the band minimizes QRM from the paging systems.

No ham activities are being coordinated in the 903 to 912 and 918 to 927 MHz ranges, keeping them clear for AVM. Amateur television users have been coordinated on one simplex channel, with a video carrier at 913.25 MHz. *[Ed. Note: In Los Angeles, 919.25 MHz is now being used for an ATV repeater output. Two are currently operational.]*

Vestigial sideband is recommended to keep lower sideband energy from affecting AVM receivers near 912 MHz. If the FCC authorizes AVM systems between 912 and 918 MHz, this band plan may have to be changed.

According to the SCRRBA Data Base Manager Karl Pagel N6BVU, other coordinating committees around the country are inquiring about the new Southern California band plan, as Teletrac and other companies expand operations nationwide. As the AVM system expands into other major U.S. cities, don't be surprised if this plan is used for your area.

Climb Every Mountain

To cover its 4,500 square mile service area in four Southern California counties, Pac-Tel Teletrac has installed 41 receiving sites. They are not at those familiar cellular phone towers along the freeways.

Instead, they are on the area's high hills and mountains, to give maximum coverage. More sites are being added to fill coverage "holes" due to shadowing in foothill areas.

The computer program is designed to calculate the location of 70 vehicles each second. Of course there aren't that many AVM-equipped stolen cars out there at one time (even in Los Angeles). The additional capacity is sold to large companies and public service agencies so they can keep constant track of all their vehicles.

Owners of large truck fleets are looking to AVM to save money by more efficient routing and elimination of empty-load runs. Putting AVM into law enforcement vehicles would allow dispatchers to instantly know which squad car is closest to the scene of an emergency.

But AVM has potential far beyond fleet management and recovery of stolen vehicles. The technology behind Teletrac was originally inspired by a well-publicized kidnapping in Florida. Teletrac marketeers say that its inventors originally set out to develop a personal tracking system to prevent similar tragedies.

Miniaturized transponders for that purpose are not here yet, but they are probably not far off.

Also in the works is a "panic button," so Teletrac owners can call for help from their cars. Designers are even considering a remote disable feature, to permit authorities to flash the lights, honk the horn, or even stop the engine when you report your car stolen.

AVM system designers have their technical problems, of course. They may be able to keep hams off their frequencies (see sidebar), but they must accept interference from other users. Military radiolocation transmitters have caused big-time QRM at high AVM receiver sites.

Industrial emitters can cause headaches, too. For instance, those anti-theft devices at the doorways of record stores can jam an AVM site under some circumstances. New state-of-the-art receivers are solving these problems.

Big Brother?

It's eleven o'clock—do you know where your car is? Teletrac owners can find out in seconds by dialing up a special phone number and giving their ID and password. I can hear it now: "Dad, can I have the keys tonight? Not for your sports car, I want the old wreck without the Teletrac!"

But don't get the idea you can use Teletrac to "bug" someone else's car. The installer is supposed to see proof of registration before installing a VLU.

The AVM market is taking off. Teletrac is going into Chicago, Detroit and Dallas/Ft. Worth this year. Miami, New York and New Jersey are scheduled for next year. Hams with a technical background in RF are finding jobs in installation and maintenance of the dozens of sites required for each system.

Teletrac has over two dozen software engineers on staff—it's a BIG computer program. Furthermore, numerous other companies are eyeing the AVM scene and making FCC applications. Perhaps there is a place for you in the AVM field.

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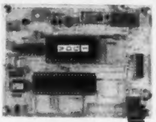

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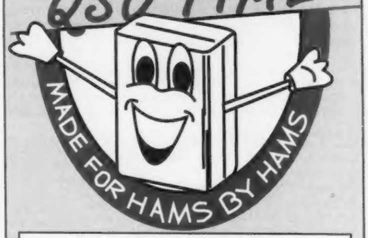
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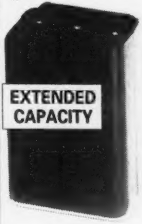

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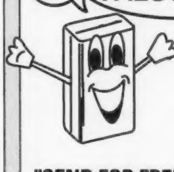

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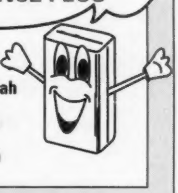

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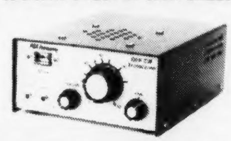

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603–525–4438) for listings that were too late to get into publication.

JUL 4

HARRISBURG, PA The Harrisburg RAC will sponsor a Flea Market at the Bressler Picnic Grounds, Exit #1 of I 283, PA 441 North, and follow signs. Admission $3. Tailgating $3. Tables in pavillion $10 in advance, $12 at the gate. Set-up at 6 AM for vendors and tailgating. No overnight camping. Talk-in: 147.30/.90 and 52/52. Contact ***Dave Dormer KC3MG, (717) 939–4957.***

JUL 5

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Bldg. beginning at 7 PM. Test fee for Technician through Extra class is $5.25. Talk-in on 147.300. Contact ***John Patchett KB2ERJ, (315) 487–0298.*** Please bring two forms of ID and a copy of your license.

JUL 6

SALISBURY, NC A Firecracker Hamfest, sponsored by the North Carolina Chapter of Triple States RAC, will be held at the Civic Center from 8 AM–4 PM. Advance tickets $3, $4 at the door. Tables $5. W5YE VE Exams at 1:30 PM; pre-register by sending 610, copy of license and $5.25 fee to ***Isabell Ledford, PO Box 826, Collamee NC 27014***. For advance tickets contact ***Walter Bastow N4KVF, 3045 Highrock Rd., Gold Hill NC 28071.***

OAK CREEK, WI The South Milwaukee ARC will hold its 21st annual "SWAPFEST" at the American Legion Post #434 in Oak Creek WI from 7 AM–2 PM. Free overnight camping. Admission $4. Talk-in: 146.580 MHz FM simplex and most local repeater frequencies. For more details and a map, write to ***The South Milwaukee ARC, PO Box 102, South Milwaukee WI 53172-0102.***

JUL 6–7

WESTON, WV The West Virginia State ARRL Convention, sponsored by the West Virginia State AR Council, will be held at the Jackson's Mill State 4-H Camp near Weston, WV beginning at 8 AM both days. Set-up Fri. from 5:30 PM–11 PM. Admission $5. Flea market tables free (admission ticket required). ARRL VE Exams at 8 AM Sat. Contact ***Bob Robinson KU8C, (304) 366–0132*** by June 30 to pre-register.. Talk-in: 144.79/145.39. For advance tickets write ***Sue Goodwin N8JNL, 103 Cleveland Ave., Nitro WV 25143.*** For info call ***Chuck McClain K8UQY, (304) 366–5401.***

JUL 7

PITTSBURGH, PA The North Hills ARC of Pittsburgh PA will hold its sixth annual Hamfest from 8 AM–3 PM at the Northland Public Library, 300 Cumberland Rd., between US Rt. 19 North and McKnight Rd., north of Pittsburgh. Free admission. Free tailgating–one space/vendor. Wheelchair accessible. Limited indoor tables $10 each. Contact ***N3DOK, (412) 367–2393*** for table info.

JUL 9–19

IRELAND Final arrangements have been completed for the first expedition to Fastnet Rock Lighthouse off the South coast of Ireland. Callsign EJ7FRL has been assigned. For info contact ***EI3GU, 31 Seaview Park, Shankill, Co. Dublin, Ireland.***

JUL 12–13

MAPLEWOOD, MI Amateur Fair '91 will be held at the Aldrich Arena. This event is oriented to amateur radio operators, electronics hobbyists and personal computer users. Outside flea market and commercial exhibits start at 6 PM Fri. On Sat. the flea market will be from 6 AM–3:30 PM; Commercial exhibits 8 AM–3:30 PM. Admission is $5 at the door. Children under 6 admitted free when accompanied by an adult. Ticket holders may sell from the giant outdoor flea market at no additional cost. For commercial booth and club exhibit info contact ***Amateur Fair, PO Box 26331, St. Paul MN 55126***, or call ***(612) 653–9999.*** Computer users can call ***HAM-LINK*** at ***(612) 426–0000*** (300–2400 baud).

JUL 12–14

NORTH DAKOTA/MANITOBA BORDER North Dakota and Manitoba's 28th annual Hamfest will be held at the Peace Garden on the USA–Canadian border. Registration begins on the afternoon of the 12th. The Hamfest will end about noon on the 14th. Breakfast for all will be on Sun. morning. Special Event Station VE4IHF/0 will operate Fri. and Sat. Ample camping spots on-site. The Peace Garden is located just a few miles north of Dunseth ND, or a few miles south of Boissevain, Manitoba.

JUL 13

PETOSKEY, MI The Straits Area ARC will sponsor a Swap Shop at the Emmet County Fairgrounds 4-H Building from 8 AM–1 PM. Tables $3–Door $2.50. RV parking on grounds. Talk-in: .08–.68 or .52. For general info/reservations contact ***Clark Rouse KA8TIL, (616) 582–6455.*** VE Exams contact ***Tom Romanauski N8KHE, (616) 436–5033.***

JUL 13–14

WOODLANK PARK, CO The Mountain ARC will hold a Flea Market Swap 'N Shop at the Red Rocks Campground, Pike National Forest. Camping in the pines; entry for camping or set-up permitted late afternoon of July 12th. Advance reservations required for overnight camping. For camping reservations write to ***MARC, Box 1012, Woodland Park CO 80866***, or call ***Joe Tafoya N0CMD, (719) 687–3641*** or ***Bob Whipple N/0FCR, (719) 687–9025.*** Free admission. Camping $7.50 per night. Tailgate space $7.50 per space (no double fee if camping and selling).

INDIANAPOLIS, IN Indianapolis Hamfest/Computer Show (Indiana's largest electronic, amateur radio and computer related market and flea market) will be sponsored by the Indianapolis Hamfest Assn. This will be held at the Marion County Fair Grounds at the intersection of I-465 and I-74 on the southeast side of Indianapolis. The show is open from 7 AM–4:30 PM both days. Tickets $8 at the gate, $6 in advance. For info call ***(317) 326–2146.*** Mailing address: ***Indianapolis Amateur Radio Assn., PO Box 11776, Indianapolis IN 46201.***

JUL 14

DOWNERS GROVE, IL The DuPage ARC will hold their 9th annual Hamfest/Electronics/Computer Show at the American Legion Post 80. Free parking. VE Exams $5.25 for all classes except Novice, which is free. Walk-ins welcome. Tickets $3 in advance, $4 at the gate. Set-up at 6 AM. Gates open to the public at 8 AM. Talk-in: 145.250/.600, 224.68/1.6, 442.55+5 PL114.8. For reservations, send SASE to ***Hamfest Chairman W9DUP, PO Box 71, Clarendon Hills IL 60514.*** For info call ***Ed Weinstein WD9AYR, (708) 985–8256.***

BOWLING GREEN, OH The Wood County ARC will sponsor its 1991 Ham-A-Rama at the Wood County Fairgrounds on Poe Rd. from 8 AM. Tickets $4 in advance, $5 at the door. Tables $10. Talk-in: 147.78/.18 K8TIH. For tables, info, contact ***Bob Fyfe KA8YWQ, (419) 352–3260.***

AUGUST, NJ The Sussex County ARC will hold a Hamfest, beginning at 8 AM, at the Sussex County Fairgrounds, Plains Rd., off Rte. 206. Free parking. Admission $4 (XYL's and harmonics free). Tailgate $6, indoor spaces $8 per space. Limited supply of tables. Talk-in: 147.90/.30, 222.90/224.50, 146.52. Contact ***Don Stickle K2OX, 185 Weldon Rd., Lake Hopatcong NJ 07849. (201) 663–0677.***

JUL 18–20

CHARLOTTE, NC Personal Computer Interfacing–Practical Instrument Automation, Networking and Control Techniques, including microcontrollers. A 3-day hands-on workshop. Contact ***Dr. Roy Jones, (703) 231–5242 or (703) 231–6478.***

JUL 20

SOUTH BURLINGTON, VT The Northern Vermont Mid-Summer Hamfest Committe will sponsor a Hamfest at the South Burlington Middle School from 8 AM–3 PM. Admission $3 (US). VE Exams at 2 PM. Tables available. Talk-in: 145.47/−600 or 146.85/±600. Contact ***Joe Tymecki N1DMP, (802) 893–6458*** or ***Tom Taylor N1EXY (802) 893–4834.***

UNION, ME The 4th annual Union Hamfest/Computer Fair, sponsored by the Maine Hamfest Assn. Inc. will be held at Union Fairgrounds on Rte. 17 from 8 AM–2 PM. Admission $2 for sellers; $3 for non-sellers. Tailgate set-up begins at 7 AM. Free parking. FCC VE Exams. Camping/RV spaces available for Fri. the 19th and Sat. the 20th. Contact ***Rod Scribner KA1RFD, 19 South Grove St., Augusta ME 04330. (207) 622–9197.***

GARDEN GROVE, CA The Catalina ARA will sponsor Hamfest '91 at Cypress College from 8:30 AM–5 PM. Contact ***CARA, PO Box 425, Garden Grove CA 92642-0425.*** (Vendors, please request vendor information).

JUL 21

WASHINGTON, MO The Zero Beaters ARC will hold its 29th annual Hamfest at the Bernie H. Hillerman Park (Washington Fairgrounds) from 6 AM–3 PM. Admission is free. Flea Market parking is $2 a space. Walk-in VE Exams begin at 10 AM. Bring original license and a photocopy. Talk-in: 147.240 repeater. Contact ***Ed Southall WD0ELL, Rt. 1 Box 105, New Haven MO 63068. (314) 459–6581.***

CAMBRIDGE, MA The MIT Electronics Research Society, the MIT Radio Society and the Harvard Wireless Club will hold a Tailgate Electronics/Computer/Amateur Radio Flea Market from 9 AM–2 PM at Albany and Main Streets in Cambridge. Admission $1.50. Free off-street parking. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Set-up at 7 AM. For space reservations or info call ***(617) 253–3776.*** Mail advance reservations before the 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in: 146.52 and 449.725/ 444.725–pl 2A–W1XM/R.

JUL 25–28

CEDAR RAPIDS, IA The 25th Central States VHF Society Conference will be held at the Sheraton Inn. This event is for all VHF/UHF/SHF operators. Pre-registration forms are available from ***Al Groff K0VM, 1446 Council St. NE, Cedar Rapids IA 52402. Home phone (319) 393–8134***. Make hotel reservations by calling the ***Sheraton Inn at (800) 325–3525*** or ***(319) 366–8671.*** To obtain the special room rate, be sure to indicate that the reservation is being made for the CSVHFS Conference.

JUL 26–28

FLAGSTAFF, AZ The Amateur Radio Council of Arizona will sponsor the Fort Tuthill Hamfest at the Ft. Tuthill County Fairgrounds. Camping facilities for self-contained campers. No power supplied. $5 per night inside fenced area. Tailgate fee is $10. Tickets $2 each or 3/$5. VE Exams on Sat. Talk-in: 147.68/.88, 447.125/442.125. For info contact ***Chairman, Lee Pemberton WB7BXB, 759–8737*** or ***Vice Chairman, Cliff Hauser KD6XH, 744-9095.***

LANCASTER, PA The Red Rose Repeater Assn., Inc. will sponsor a Computer Fest at the McCaskey High School from 9 AM–3 PM. Set-up at 7 AM. Admission $4 with children under 14 free if accompanied by a paying adult. Talk-in 147.015/.615. Mail ***Red Rose Repeater Assn., Inc., PO Box 8316, Lancaster PA 17604.***

JUL 27

NORTH BEND, OR The Coos County Radio Club will sponsor a Radio/Computer/Electronics Swap Fest at the North Bend Jr. High School from 0900Z–1700Z. Free RV/SC parking all week end. VE Exams. Advance tickets $4, $5 at the door. Tables (8′ x 30″) $15. Commercial Space @ $30.00. Only one free admission per seller, regardless of number of tables. Set-up July 26th, 3PM–6 PM; July 27th, 6 AM–9 AM. Make checks payable to ***Coos County Radio Club, PO Box 349, Coos Bay OR 97420.***

JUL 27–28

OKLAHOMA CITY, OK The 18th Annual Ham Holiday 1991 and ARRL Convention, sponsored by Central Oklahoma Radio Amateurs, will be held at the Hobbies, Arts & Crafts Bldg, Oklahoma State Fair Park. Doors open at 8 AM both days. VE Exams both days. Saturday evening banquet (Tickets $8.50); Flea market, new and used equipment, forums. Admission $6 in advance or $8 at the door. Tables $5 in advance, $7 at the door. Talk-in on 147.03/.63 and 444.20/449.20, PL is 141.3. Send registration to ***CORA Ham Holiday 1991, PO Box 95942, Oklahoma City OK 73143–5942.***

JUL 28

TIMONIUM, MD The BRATS Maryland Hamfest/Computer Fest will be held at the Maryland State Fairgrounds. Set-up at 2PM Sat. and 6 AM Sun. There is no set opening hour. 8′ tables (no power) are $25 each. Write or call for special discount rates for 10 or more tables. Tailgating is $5 per space, on sale on the day of the hamfest. Free VE Exams will be held in the Administration bldg. at 10 AM only. Pre-registration required. For Exam info and reservations write to ***BARC, PO Box 120, Reisterstown MD 21136.*** For table reservations and hamfest info write to ***BRATS Hamfest, PO Box 5915, Baltimore MD 21208***, or call ***Franz N3HFS, (301) 583–9147***, 24 hours a day.

SPECIAL EVENT STATIONS

JULY

VERMONT Vermont Special Event Stations will operate 25 kHz up from the bottom of the Novice and General band throughout the year, to help Vermont celebrate its 200th Birthday. RTTY/AMTOR/etc. will be in the digital sub-bands. To obtain a Special Certificate, send $1 and SASE to ***Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654.*** Foreign stations, send only SAE and IRC's to cover postage.

JUL 4–6

LOUISVILLE, KY Louisville's Freedom Hall will be the site from which Special Event Station W4CN will operate to celebrate the International Barbershop Singing Convention. Time: 1200–0300 UTC. Frequencies: 20–, 15– and 10 meter SSB, as well as 2 meter FM. Sideband frequencies will be 14.225/.245 MHz, 21.30/.32 MHz and 28.30/.32 MHz. FM operation will be on the Louisville 147.18 MHz repeater and 147.58 MHz simplex. Talk-in will begin on Monday, July 1st, on the repeater frequency. All amateurs contacting W4CN will receive a special commemorative QSL card, courtesy of Yaesu USA. The station is sponsored by members of the amateur Radio Transmitting Society of Louisville. Contact ***Gil Hibben N4LRF, Amateur Radio Transmitting Society, PO Box 7391, Louisville KY 40257–0391. (502) 222–1397*** (daytime).

JUL 6

DELTAVILLE, VA The Middlesex AR Group will operate KB4NGO, 1230–2030 UTC to commemorate Deltaville Heritage Days. Operation will be in the General portion of the 80, 40 and 20 meter bands. For certificate send QSL and SASE to ***Fay Smith KB4NGO, M.A.R.G., PO Box 88, Hardyville VA 23070.***

JUL 6–7

DELTA COUNTY, MI The Delta County ARS will celebrate its 20th Anniversary as an affiliate of the ARRL by operating Station K8ZAS from 1400–0100Z Sat. & Sun. Bands: 10, 15, 20, 40, 80 meter. Frequencies: 28.357, 21.357, 14.280, 7.280, 3.980; CW: Novice CW frequencies. Contact ***Denise, PO Box 923, Escanaba MI 49829.***

LAPORTE, MN The Cass-Hubbard County ARC will operate N0GFK 1500Z 6 July–0300Z 7 July, to honor W0LSC, W.C. Soderlund, formerly of Laporte High School, for writing the curriculum and teaching the First High School Radio Theory Class in Minnesota. The station will operate SSB in the General portion of the 75, 40, 20, 15 and 10 meter bands. Mr. Soderlund will participate as one of the operators while being the Reunion Guest of Honor at the 75th Anniversary of the High School. For certificate, send QSL and SASE to ***W6AAQ, Box 595, Esparto CA 95627-0595.***

JUL 10–11

VERMONT A Special Event Station will operate for the State Capitol Building. The hours are 10 AM–3 PM. The State of Vermont is also providing a special gift to be included with the certificate for those contacts made on the 10th and 11th. Contact ***Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654*** for more info.

JUL 11

PUAKO, HI The Big Island of Hawaii will experience a partial and total solar eclipse from 1630–1837Z. Members of the Big Island ARC will operate Station NH6ES from 0001—2400Z, at Puako HI (within the path of the eclipse). Operation will be in the Novice part of the 10 meter band and in the General segments of the other HF bands. Special QSL cards to those contacting NH6ES. QSL to: ***BIARC, PO Box 1938, Hilo HI 96721–1938.***

JUL 12–13

NORTH DAKOTA/MANITOBA BORDER Station VE4IHF will be operated from the International Peace Garden from 9 AM—6 PM CST. This year the Station will be on with digital modes as much as possible, as well as phone. For a Peace Garden certificate, send 2 IRC and SASE or 1 IRC, SASE and QSL card, to ***Dave Snydal VE4XN, 25 Queens Crescent, Brandon, Manitoba, Canada R7B 1G1.***

JUL 13

WESTON, WV In conjunction with the X-Mas in July celebration at Weston Hospital, the Central ARA of West Virginia will operate Station N8FIP on 10, 15, 20, 40, 80 meters SSB and 20 meter packet, from 1600–0400 UTC. Weston Hospital is

Continued on page 79

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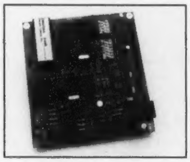

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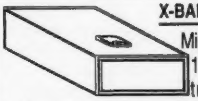

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The introductory price of the fully assembled desktop enclosure kit, tested and burned-in, is $375, which includes a full memory configuration and an audio/PTT output cable for any standard amateur transceiver. Factory-assembled VB-8A kits have a 30-day money back guarantee and a one-year warranty. Contact *Advanced Voice Products, P.O. Box 1064, Mauldin SC 29662; (803) 676-1111.* Or Circle Reader Service No. 201.

TELEX COMMUNICATIONS

The Hy-Gain group of Telex Communications has introduced the CONTESTER boom-mike headset. It features a noise-cancelling dynamic mike that favors the voice range (100–8000 Hz) for maximum intelligibility. The mike boom rotates so it can be worn on the left or right side of the head and automatically shuts off the mike when placed upright. The headset's receivers have a 50–15,000 Hz frequency response and compatible impedance for amateur transceivers. The 5′ (1.5m) headset cord is unterminated, to accept any connector suitable for the user's transceiver.

The suggested list price is $102. Contact *Telex Communications, Inc., 9600 Aldrich Avenue South, Minneapolis MN 55420; (612) 884-4051, FAX (612) 884-0043.* Or circle Reader Service No. 202.

OE2DYL

"DX Nets Around the World," List 10, is the new 1991 edition of OE2DYL's popular list containing data about more than 100 active DX nets. The price is US$4 (airmail) for this new list, or US$15 for the package of all 10 editions. OE2DYL is also offering "DX Beam Headings," with short- and long-path bearings and distances to more than 450 locations throughout the world for US$25 (airmail). No checks. To order, contact *Dieter Konrad OE2DYL, Rosengasse 1, A-5020 Salzburg, Austria.* Include an SAE.

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EPO Software has released a family of copyrighted logging software specifically designed for amateur radio operators. These databases have been developed, refined and improved with the input of thousands of hams worldwide. Each program can generate high-speed hard copy, video or ASCII log files, is suitable for single band or multiband use, and is user friendly and flexible. ELECTROLOG II, "The Electronic Logbook," is a sophisticated, general purpose logging and QSLing program, priced at $19.95. CONTEST LOG & DUPE SHEET ($14.95) is an easy-to-use contest log program featuring RAM-based duping, error-free default entry, and super-quick searching. DXCC AUTOLOG and WAS AUTOLOG ($14.95 each) are specialty logging programs designed for DXers and award hunters. TEN-X LOG ($14.95) is a unique data base that will sort and alphabetize by a variety of fields, including callsign or membership number.

There is a $2 shipping charge for each order. For more information, contact *EPO Software, 7805 N.E. 147th Ave., Vancouver WA 98682; (206) 892-1679.* Or circle Reader Service No. 205.

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Muscle Products has announced a new, unique demoisturant and corrosion preventative, MO-10 MOIST-OUT. This product removes water from circuits and circuit boards, preventing corrosion, and is also a light lubricant and penetrant that will reject and repel dust because of a petrochemical bonding technique that repels airborne contaminants by causing a dipole-dipole interaction, or "cation exchange," on the surface of the metal. MO-10 also removes corrosion and corrosion bridges from PC boards after a light spray and brush application, and prohibits further corrosion from taking place. Its dielectric strength is rated at 45 kV.

MO-10 is available in 16 oz. plastic pump spray bottles, 5 gallon pails, and 55 gallon drums. The suggested retail price for the 16 oz. bottle is $6.39, plus S & H. (Say that you saw it in *73* and get a 10% discount.) For more information, contact *Muscle Products, 188 Freeport Road, Butler PA 16001; (800) 227-7049, (412) 283-0567.* Or circle Reader Service No. 204.

WHATS-UP

WHATS-UP 1.00 is a software tool providing radio amateurs, or educators, with the capability to perform experiments in spacecraft orbital dynamics, as well as monitoring the environment on board several of the OSCARs during individual passes or over long periods of time. Capturing, decoding and displaying telemetry from orbiting spacecraft in real time, in the classroom, is an excellent way of introducing space science to students. WHATS-UP lets you do this using readily available low cost equipment. The documentation covers telemetry, the spacecraft themselves, receiving antennas, radio receivers, modems, and the software used to both decode and display the data in real time and to do a post-pass analysis.

WHATS-UP is available for $35 for a single copy, or $195 for a classroom license of up to 10 users. Contact *Joe Kasser, POB 3419, Silver Spring MD 20918; (301) 593-6136, data BBS (301) 593-9067, CompuServe 70531,1405.* Or circle Reader Service No. 206.

QSO SOFTWARE

QSO Software's new program, QSO Comp-Troller™, provides the ultimate companion for controlling your late model Kenwood radio. It is composed of two programs, one for the Macintosh and one for MS-DOS machines. It will manage the interface between you and any Kenwood transceiver that supports the IF-232C interface. Frequencies can be directly inputted by clicking on the VFO, Memory, or SubBand, then keying in the new frequency or modifying the existing one. Memories can be read from the transceiver and stored on disk or read from disk and transmitted to the transceiver. The program also keeps track of any adjustments made directly on the rig and reflects them on the computer display.

The suggested retail price for the QSO Comp-Troller is $99.55. For more information, contact *QSO Software, 208 Partridge Way, Kennett Sq. PA 19348; (215) 347-2109.* Or circle Reader Service number 207.

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Laser Communication Systems

This month I will continue detailing construction of a complete laser communications system. Last month I went over the basic power supply for the HeNe (Helium Neon) laser that serves as system transmitter. This month we will get into the parts needed to construct a light detector coupled into a high gain audio amplifier to serve as system receiver.

The optical detector converts the laser beam into a signal coupled to the audio amplifier. A 12 volt muffin fan modulates the transmitter by passing the laser beam through the spinning blades. The fan blades, spinning at about 1 kHz, chop the beam into segments, which the receiver detects.

We can refine the audio amplifier design, but we must stop at some point for stability. Additional system gain can be obtained by optical gain, using a telescope or, in our case, a large fresnel lens which focuses energy onto the detector element, converting light to a DC current.

The Amplifier (Receiver) Circuitry

The audio amplifier circuitry is shown in Figure 1. From the gain potentiometer (10k) to audio out, it is nothing more than a basic audio amplifier. The first stage is quite special as it provides gain at 1 kHz which is centered about the transmitter audio frequency. This is due to the feedback network between pins 8 and 9. Initial tests showed that light sources such as argon and sodium lamps gave off a 60 Hz hum when the detector was pointed in their direction. The feedback circuit did well in limiting the hum, saving our eardrums.

The pin diode detector is the current-feed to the op amp. If all is working well, when you point the detector at a neon lamp you will hear a 60 Hz hum in your system. If your laser is operational, being chopped by the muffin fan, you will hear the 1000 hertz tone.

Don't point the laser at the detector; point it at some distant object—say, the end of your work bench, and point the detector in the same direction. As your lens and system become more sensitive, this distance can be increased.

A Few Basics

The frequency of a HeNe laser is 632.8 nanometers or 6328 angstroms. One angstrom is equal to one ten-thousandth of a micrometer. If you want to work that out to frequency, it comes to 474 THz, or 474,083 GHz if you prefer. This frequency of light is in the visible spectrum, and appears as an intensely bright red beam. Most supermarket bar code scanners use HeNe lasers, which suggests a source for surplus.

The word "laser" originated as an acronym for "Light Amplification by Stimulated Emission of Radiation." HeNe lasers are composed of a glass tube filled with a gas mixture. High voltage (around 10 kV) impressed across two electrodes is necessary for initial ignition of this gas, and 1500 to 2500 volts is necessary to maintain operation. The lasing action takes place in a fine capillary tube housed inside the main tube. The open end of the capillary tube is pointed towards the output or partially reflective mirror end of the laser.

Buying Lasers

Lasers can be purchased in two forms: plasma tubes or heads. A plasma tube is a laser with just the glass envelope. A laser head is a plasma tube mounted inside a metal tube with a high voltage cable and connector attached. Usually a ballast resistor, located inside the tube, comes as part of the "head."

You should check to determine if your head has a ballast resistor. THIS IS A VERY IMPORTANT STEP. If you try to connect a power supply and there is no ballast resistor on the head, you may damage the tube if the current flow is higher than normal.

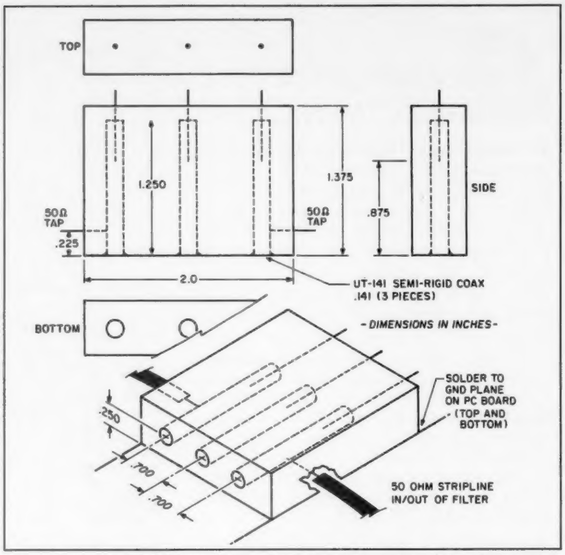
TOP
1.250
1.375
SIDE
50Ω TAP
.225
50Ω TAP
.875
2.0
UT-141 SEMI-RIGID COAX .141 (3 PIECES)
BOTTOM
- DIMENSIONS IN INCHES -
SOLDER TO GND PLANE ON PC BOARD (TOP AND BOTTOM)
.250
.700
.700
50 OHM STRIPLINE IN/OUT OF FILTER

Figure 2. Filter for 1296 MHz using 0.141" rigid coax. Three dB bandwidth of 14 MHz. Ten dB bandwidth of 28 MHz. Total loss through the filter is 2 dB. (Construction details by Chip Angle N6CA.)

If in doubt about whether your head has a ballast resistor, you can add one before you do your first test. You can always remove it if it's not needed. The idea is to limit current to the tube. Insufficient current does no harm. A 10 mW laser requires about 6 to 7 mA, while a 2 to 3 mW laser needs only a few mA. My laser, obtained from a junk high speed commercial printer, has a power output of 10 mW. This makes it a class III laser, since the output is between one to several hundred mW.

BE VERY CAREFUL. Looking into any laser, particularly a class III, can cause eye damage. Believe me, this beam is extremely bright. Looking at it from the side, you may think it's not that bright, but trust me: It is. Also, though its spot size is small, beware of looking at its reflection. This can cause discomfort.

I found a supplier for lasers and laser power supplies that is quite reasonable: Karl Gedeon, P.O. Box 2336, Stanford CA 94309. A complete 10 mW laser head and 12 volt power supply from Karl cost only $100, and 2 to 3 mW lasers are quite a bit less. He also stocks laser related components, including laser pointers in the 2 to 3 mW range (small) and higher power pointers. I purchased a system from him and was very pleased. He also has 2 to 4 mW pointers, all operating from 12 volts DC.

In our first experiment, we used a laser transmitting over a two mile plus path with the beam so bright at the receive site that it appeared to be four city blocks on fire. There was not a city light, even at a nearby shopping center complex with all the sodium parking lights on, that could give a comparable brightness on the horizon. Only the street light nearby was comparable, but it wasn't as bright as the laser. At this two-mile distance, the 1 milliradian spot size (at the transmitter) had increased to a 5-foot wide spot.

Set-Up and Testing Details

Let's get into the details of the system that Kerry N6IZW and I put together for the test just described. The laser power supply was operated from the 110 VAC mains, so it remained at Kerry's home. Modulation of the laser was done with a 12 volt DC muffin fan. The receiver was a photo PIN detector salvaged from scrap medical equipment. The detector was tied to a current amplifier for a first stage to give low noise amplification of the signal coming from the detector. The remaining circuitry is an audio amplifier that amplifies the 1000 Hz modulation from the transmitter.

Many different types of lenses were employed on a hand-held optical bench to evaluate the performance of the test lens and the detector. It was found that a Radio Shack "cigarette" parabolic reflector about three inches

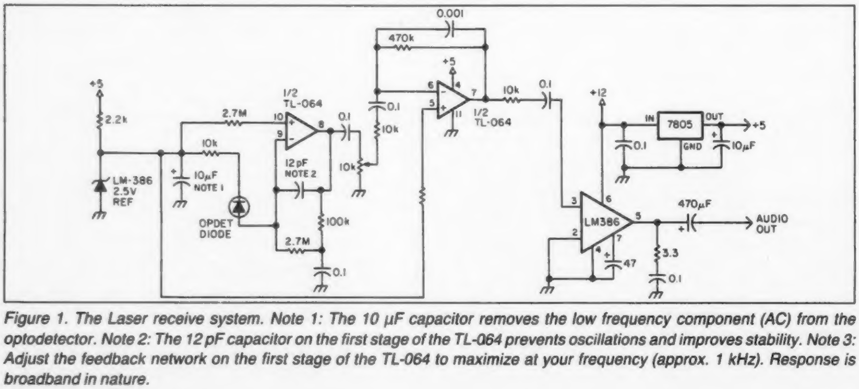

Figure 1. The Laser receive system. Note 1: The 10 µF capacitor removes the low frequency component (AC) from the optodetector. Note 2: The 12 pF capacitor on the first stage of the TL-064 prevents oscillations and improves stability. Note 3: Adjust the feedback network on the first stage of the TL-064 to maximize at your frequency (approx. 1 kHz). Response is broadband in nature.

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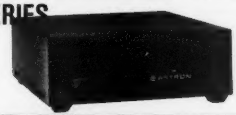

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SL-11A	•	•	7	11	2¾ x 7⅝ x 9¾	11

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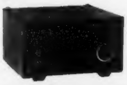

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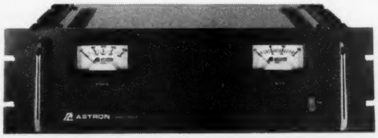
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7



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MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

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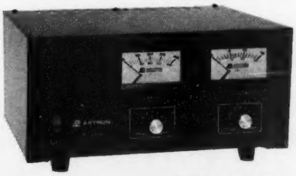

MODEL VS-35M

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MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

in diameter would give a good signal, focusing the laser beam into the detector. Several other items were tried, including a magnifying mirror, and they all worked. The larger the "lens," the better the light gathering or total system gain.

Then we tried an 8" x 10" fresnel lens, not a high quality type, but rather one intended for magnifying print for reading, with a focal length of 10 to 11 inches. The best part of this lens was the cost, $1.50 at most stationery stores. It worked super.

Kerry found a plastic trash can at a local store and mounted the lens on the open end, and placed the detector on the center bottom. The lens was built out a little bit to achieve proper focus depth to the diode. In initial tests with this detector system, we were able to detect the reflection from the laser at almost anything we were able to see. The spot was reflected off of trees and wires at half a mile and more.

Improvements

This proved to be an excellent test because it was so simple and gave positive results of sensitivity and system evaluation. Several improvements were made, pushing the reflection detection range further out. The first modification pushed the range out to over 1000 feet. Street lighting created 60 Hz interference and high level annoyance in our ears. The feedback scheme to solve this, mentioned earlier, was developed by Kerry N6IZW. It worked so well I could not believe it. This mod pushed the detection range to just perceivable light reflections with the trash can and fresnel lens system.

This system was so sensitive that we could point the detector skyward and detect other interesting noises. One noise source was aircraft strobe lights. They sounded like a dull *thud, thud* at the strobe rate. When the aircraft was prop driven, and its attitude just right, we could hear the running lights being chopped by the propellers at a high audio rate. No noise came from incandescent lighting, however fluorescent, sodium, and similar type streetlights would project at the AC switching rate. This was plainly heard on the headsets. These lights could be picked up many miles away.

Even during very heavy cloud cover on a pitch black night, Kerry was able to hear the strobe of an aircraft. Pointing was not critical, as the cloud cover defused the strobe light. He could not see the light visually, which illustrates the system's sensitivity.

The PIN photodetector system is quite easy to use. With minor circuit changes, other types of detectors could be used. The trade-off is sensitivity. There are photo transistors, photoresistive cells, and photo darlingtons, as well as photo FETs. These are all sensitive, but one device that shines better than most is the *photo multiplier tube*.

The PIN diode is quite good, but the photo multiplier is superior and easier to find in surplus. One difficulty with the PMT, however, is that it requires a high voltage power supply operating at 1000 volts with 2 or 3 mA. I will get into the PMT next month and try to give you enough details to construct a very good system from the junk box.

Mailbox

Jim WA9PYH is looking for information using stripline techniques to construct a filter for use at 1553.5 MHz. He wonders what length a stripline should be to resonate at a particular frequency. Well, most stripline filters are made with 50 ohm transmission lines on 0.062 PC board, making line width about 0.100 inch (G-10 glass epoxy) and 1/4 wavelength long.

Now, the trick is that the actual length (1/4 wavelength) is modified by the velocity factor of the dielectric material, and any external or tuning capacitor. The velocity factor for G-10 PC board material runs from 0.50 to about 0.57. This factor is multiplied by the 1/4 wavelength to arrive at the actual line length. The line is or should be near resonance as it sits. Normally, 1/2 wave lines are used for filters coupling in and out with 1/4 wave sections.

Additional tuning elements shorten the line sections quite a bit, and can factor up to 0.5 to 0.6 or more, depending on type. In a filter for 1152 MHz, the line length is about 0.400 inches long. Tuning is done with a 5 pF variable capacitor to ground. So you see just how short this filter is by adding a capacitor to tune the stripline. Don't forget to couple in and out of the line at the 50 ohm point, which is 20% to 35% up the stripline from the the grounded end.

I sent Jim a few other design notes on other filters I have tried, including one that used 0.141 rigid coax to construct a very good filter for 1296 MHz. This design was first spotted in a note from Chip N6CA for 1296 MHz, several years ago. He had taken short sections of 0.141 hardline and positioned four of them in an enclosure, feeding them with stripline in and out of the filter. Tuning was accomplished by pulling the center of the coax out of the far wall of the filter through a good ground connection. This formed a capacitor with the 0.141 hardline. When the frequency was properly set, the center of the coax was soldered to the cover housing the filter. See Figure 2 for construction details.

Bill N6OLD writes about his 24 GHz operations. His recent contact might be a record; if not, it's certainly quite an accomplishment. On February 23, 1991 at 5:25 p.m., KK6T/6 (ex WB6HLC) and N6OLD made an SSB contact between Hull Mountain CM89MM (6100 feet) and Mount Diablo CM97BV (3800 feet), covering a distance of 125 miles. KK6TG's equipment was an 18-inch dish and a 14 dB noise figure pre-amplifier capable of +7 dB output power on transmit. N6OLD sported a 20-inch dish, 12 dB noise figure pre-amplifier and about +2 dB output power.

An earlier test at 2:32 p.m. between another site and Mount Diablo revealed stronger than expected signals, 40 dB out of the noise, so a longer shot was tried. The Hull Mountain shot had an even stronger signal, which suggests ducting. The low humidity (16% R. H., 50 degrees F) also helped.

Note that 24 GHz operations are right in the water absorption band, making attenuation to 24 Ghz operations higher. For least attenuation, it's best to operate when humidity levels are low. Bill is currently exploring water absorption effects and investigating propagation in this interesting (24 GHz) band.

Next month I will cover the PMT in more detail. As always, I will try to answer your questions about microwave and related topics. Please send an SASE for a prompt reply. 73s, Chuck WB6IGP 73

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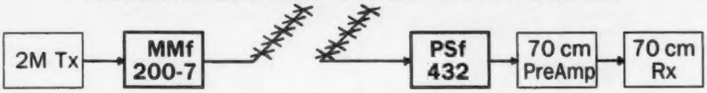

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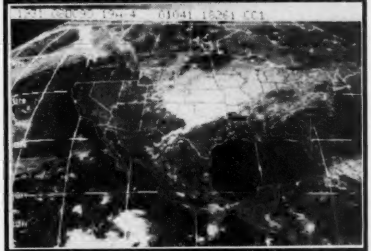

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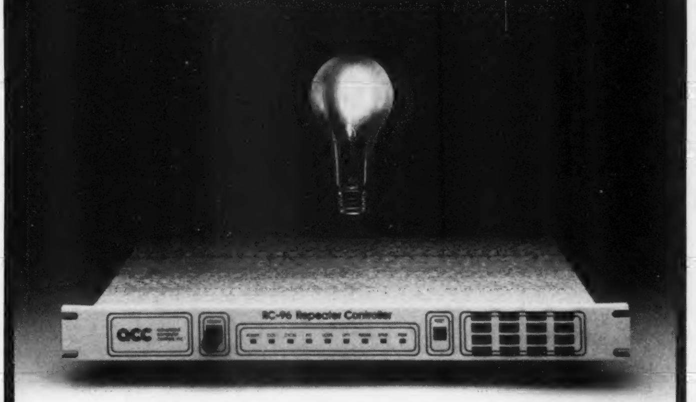

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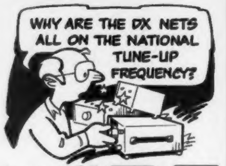
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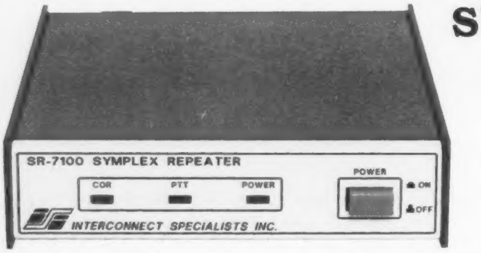

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Back to the Beginning

With appropriate ruffles and flourishes, I am pleased to note that this month begins the 15th year of "RTTY Loop"! Rather than wax nostalgic, as I often do at anniversaries, let me just say that this column has covered a lot of ground these many years, and has evolved in more ways than one.

This month, to start out, I'd like to drop back to a basic question. This was prompted by a letter from Gregory McIntire KE0UV of Belle Fourche, South Dakota, that surfaced from the stack on my desk. It's one of the "Oh, I know the answer to this" questions that soon becomes mired in too many answers.

Gregory would like to know how to determine the exact frequency that a RTTY, AMTOR, or packet station is operating on.

Exploring the Question

To quote KE0UV: "When operating CW, I think there is little question of what the operating frequency is. Whether the digital display of a transmitter is accurate or not, I think that it is understood that the frequency of operation is the actual and exact radio frequency which is radiating from the antenna. When operating SSB phone, the actual frequency radiating from the antenna varies with the modulating audio. So, we designate the 'operating frequency' as the frequency of the suppressed carrier. This 'suppressed carrier' frequency does not ever radiate from the antenna during an SSB phone transmission, though. Nevertheless, we specify the particular sideband along with the suppressed carrier frequency as the frequency of operation. But when it comes to the FSK modes, there seem to be differing opinions.

"Some rigs use two audio tones generated by a modem (TU), fed into the mike jack, in SSB mode (usually LSB) to generate FSK at radio frequency. When this method is employed, and using LSB, the two RF frequencies radiating from the antenna are the 'suppressed carrier' frequency minus the two audio frequencies. This means that the higher audio tone will create the lower RF frequency, and vice versa. If the two audio tones used are 2295 Hz and 2125 Hz, and the suppressed carrier frequency is set at 14.100 MHz (LSB), then the two RF frequencies will be 14.097705 MHz and 14.097875 MHz. If we use the LSMFT rule [Low Space Means Fine Teletype], the higher audio tone generated in the modem causes the lower RF, or space frequency, to radiate from the antenna.

"Other rigs use a direct FSK scheme which does not use SSB. The modem or terminal unit simply sends a high or low voltage to determine whether to transmit the higher or the lower radio frequency. This would be the same as two different CW signals transmitted alternately. It is my understanding that some transceivers, in FSK mode, display the lower RF at the digital readout, while others display the higher frequency as the frequency of operation.

"It has been my personal experience that many, if not most, hams determine their frequency of operation to be that which the digital readout is displaying during transmission, regardless of which of the two types of signal generation is employed. Using the 'two audio tones into LSB' (often referred to as AFSK) method, the actual frequency radiating from the antenna could be 2.295 kHz (or more) lower than what the readout is displaying. Conversely, using the so-called 'direct FSK' method, the readout should display one of the two RF frequencies correctly.

"Anyway, back to my question. What is the correct designation of a two-tone, RTTY, AMTOR, or packet operating frequency? The lower radio frequency, the higher radio frequency, the suppressed carrier frequency, or none of these?"

Gregory, I really think this is a landmark question. It has advocates on all sides. I turn it over to the readership—to all of you—for input, and look forward to forming some kind of consensus. Who knows, maybe we will even turn this into some form of necessary standard! At any rate, readers are invited to send their votes and opinions to me, at the designated address, for inclusion in a future column.

More Questions and Answers

Always looking forward to a view of another ham's messy shack, I appreciate the photo of Michael Freedman VE3BGE, hailing from Toronto, which I share with you all herewith. His station sports an impressive assortment of radio gear. Looks good, Michael, and thanks for the photo. Sure folks, go ahead and send me photos of your junk, too. You never know just what you'll find in "RTTY Loop"!

Back in February 1991, I passed along Norm WJ5Z's request for a Morse code copying program for the Color Computer. Ed Tyson N5JTY of Alamogordo, New Mexico, reached back into his memory cells for the answer. In December 1982, the late *80 Micro* published an article called "CC CQ," by Michael Chuck of Severna Park, Maryland. In this article, a transmitting and receiving Morse terminal for the CoCo is described.

The article, which also includes a complete listing for a program to accomplish the task, is far too long to reprint here. If you insist, and cannot dredge up a copy anyplace else, I can be persuaded to send you a copy, for the customary $2 and a LARGE self-addressed, stamped envelope with two ounces' worth of postage.

Last for this month, thanks to Domenic M. Mallozzi N1DM of Watertown, Massachusetts, for a comment he sent me. Dom recalls my question regarding mechanical teleprinters, and states that his station ". . . is a Model 15 page printer [he has both a commercial and a military version], a HAL ST5K demodulator, and a home-brew AFSK running into an old Heath HW-101 transceiver."

Dom also notes that he has "about 100 QSOs on RTTY from W1AW over the past ten years. . . . Don't know if the visitor's RTTY position exists in the new station, but I hope so. One of the operators there told me that very few visitors ask to operate RTTY. He said he could only remember two others in the last five years."

I'm fairly caught up with responses to your questions, and with requests for copies of the programs recently described. If you have not heard from me within a month or so of your letter, odds are that I did not receive the initial question. As always, direct your comments, questions, suggestions, and barbs to me at the above address, or via CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). I look forward to hearing from you in this, the 15th year of RTTY Loop. 73

VE3BGE
TORONTO
CANADA

Michael Freedman VE3BGE, from Toronto.

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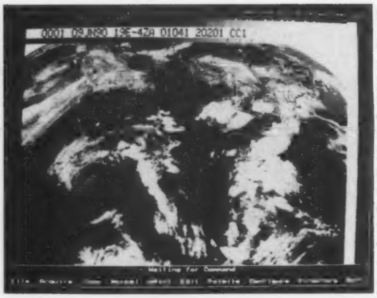

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Never Say Die

Continued from page 4

you about my getting on 75m to give some of the DXers a new one and couldn't find one single taker? The nets told me to get off the frequency because my signal wasn't strong enough to bother listening to. Okay, so I've told you about that.

One fact of life is that either you have some goals and excitement or you're going to vegetate and die. No, I'm not suggesting you get involved with DXing; we're already up to here with those ruthless fanatics. We do need a lot more DXpeditioners. We need more experimenters to pioneer new modes. We need more packet ops. But mostly, and by a wide margin, we need kids. So spend some time and go out there and poison their dirty little minds with the glories of hamming. Lie a little. Get 'em to come over to your shack.

Now wait a minute. When you get 'em into your shack I don't want to hear that you fired up and made a couple CW contacts while they got bored out of their gourds. Find something interesting for them . . . if you can. Can you show them some packet? How about a few slow-scan pictures from some weird country they've probably never even heard of?

Then tell them about the fun you've had on hidden transmitter hunts. Tell 'em about Dayton and its endless flea market. Tell 'em about Dayton and 30,000 hams, all with HTs on their belts, all squawking away at once.

Tell 'em about your local club meetings where a few old-timers do everything in their power to make it miserable for kids. No, better not tell 'em about your club meetings with endless and pointless business discussions over total trivia, followed by a lack of an interesting speaker. Maybe they'll come for the doughnuts and die of cholesterol.

A chap who runs a happiness radio program out in Michigan somehow got hold of me and got me to talk over the air about happiness. Now I may grouse in my editorials, but that's just my futile effort to whip you out of your rut and keep you alive a little longer. The fact is that I'm having a ball. You know my goals . . . like helping the music industry to grow and revamping the American educational mess so we'll have ten million excited young hams instead of a few hundred doddering old codgers whining and kvetching on our bands.

I'm having fun! Every day is a challenge. I wake up around 4 or 5 a.m., shuffle into my office across the hall and start answering my mail, writing editorials for a dozen or so publications, doing business plans for new publications, and so on. Pretty soon it's 7 a.m. and time for breakfast and a check on the news. Hmmm, the news is lousy. Wars, civil and uncivil, in a couple dozen countries . . . many of which I've visited and operated from. Starving children. Refugees. Enough of that stuff . . . perhaps it's time to write King Hussein and tell him how to fix the Palestinian mess. Or give Bush some guidelines on new approaches to education . . . he sure could use 'em.

Naw, there's still a stack of mail I haven't answered. Some chap in Poland loves my music magazine and wants to be an Eastern Europe correspondent. A chap in Sabah wants to open a CD store. Another wants my opinion of his Portuguese organ music CD. Two responses to my call for ham industry people to volunteer to go to Washington with me to talk with the Commissioners and answer their questions about amateur radio.

If happiness helps keep people alive, which I think has been rather well documented, then you're going to be reading my editorials for a long time to come. I'm having a ball. My only major problem is in finding a few more competent and enthusiastic people to help me have fun. That's a downer . . . but it's compensated for by the wonderful group of people I've already got working with me. And best of all are the letters from readers. Those I love.

73 readers write to tell me they're having fun as a result of this or that article. Or that they've taken off 85 pounds, just like I did. Or that they've gotten a dozen new youngsters licensed. My *CD Review* readers write to thank me for getting them interested in some new kind of music . . . like ragtime . . . telling me how much enjoyment they're getting from reading the magazine. I love hearing from advertisers telling me how well their ads are doing for them.

I love visiting schools and teaching youngsters about amateur radio and entrepreneurialism. I love letters saying, hey you were right about packet, RTTY and so on. Retire? You're kidding! I've got too much to do. And so do you.

Those Damned Japanese?

Are you still grousing about the Japanese? About how they came along and grabbed our consumer electronics industry and parlayed it into dominating the whole financial world? About how they're buying New York and Hollywood? About how they now dominate our movie and music industries as well as every aspect of consumer electronics?

Well, I suppose some myopia helps keep us from blaming ourselves. You should see the angry letters I've gotten from automobile union members when I groused about Detroit cars recently! Actually, if you want to blame someone, why not pick on Ed Demming, the chap that Japan listened to and we ignored? Ed preached quality and Japan bought the idea. They imported Ed and got him to preach from one end of Japan to the other . . . and even better, they listened and did what he said.

Ed tried to sell the idea of quality here in America and was told to shut up. Alas, the concept is still alien here. I find myself driving Detroitmobiles when I rent cars on trips, so I know how they compare with my Toyota Previa. Other than being brainwashed by enormous advertising budgets and lavish rebates, I don't see why people are buying Buicks. Quality? Har de har!

Sure, my father bought Fords in the '30s and I followed suit, but when I discovered the Porsche Speedster in 1957, that was the end for Detroit. I tried a Dodge van in the '70s and had so much trouble no power on earth would ever get me near a Chrysler product again. The dealer screwed me. Chrysler could care less. My van would stall and not be restartable without pouring gas directly into the carburetor. A ham friend dug up a confidential factory notice to dealers admitting the problem and the lack of a known repair to fix it.

I find my own organization ignoring quality, despite my constant preaching and fussing. The company that handles our subscription list manages to send renewal letters in the wrong order or at the wrong time. They send renewal #4 for the first renewal effort. Subscribers tend to get furious when they get word that their subscription has already lapsed.

So what can we do? It still takes too big a computer for us to do the work ourselves. In another year I think there will be some software available that may allow us to handle our own circulation fulfillment with a super-microcomputer. I sure hope so.

The basic problem seems to be an American lack of thinking in terms of the importance of quality. We give lip service to the customer being right, but when we are dealing with a customer many of us tend to forget their perspective and just think of how much trouble this is for us.

More than one *73* editor has gotten his walking papers when I found, after many warnings, that he was still making authors wait for weeks to get a response. And I found a customer service person who had a switch installed to turn off the bell on her phone so she wouldn't be disturbed by complaints.

A good deal of this comes down to the kind of education we're providing. By the time our kids are in the work force it's too late. So we put up with toys that break, cars with doors that don't fit and engines that won't start.

To the Detroit workers who bitched to me about my love of Japanese (and German and Swedish) cars, I say take a look at the recent *Consumer Reports* issue that listed the repair records for all cars. The Detroit cars are a disgrace compared to most foreign cars.

Yes, it's difficult to adjust to the encroaching world economy. We've been so steeped in nationalism all our lives that we can't really understand about things being made where it's the cheapest to make them. Today we have products where parts are made in Singapore, parts in Japan, and assembly is in Mexico. How do we cope with that? How do we educate our children to come out on top? Blue collar jobs are going away to lower wage countries as communications and transportation costs drop. Technology is in the driver's seat, not the farmer or the factory worker. Yet we're letting our kids grow up technological illiterates. Yes, I know, we're too busy watching a ball game on TV, so we'll leave it up to our schools to teach our kids. That's not our responsibility any more.

And look at the fantastic socialist system we've built to teach our kids. We tax the heck out of ourselves and ignore that most of the money gets lost in the socialist bureaucracy and that only about 10% dribbles down to the kids. When we find it isn't working we ask for more money to feed the bureaucracy. It responds by adding more bureaucrats and 9% dribbling down to the kids. Parkinson wrote an expose of this syndrome back in the 1950s. Nothing has changed.

What's this got to do with amateur radio? Presumably you come out of the hamshack sometime and have thus, even if accidentally, procreated some kids. Well, how many of them are active amateurs? How many are gung-ho for a high-tech career? And who won the pennant in 1984?

If the schools stink, how about teaching your kids yourself? I'd love to see some articles on how to suck our kids into hamming. If you even give a hint that you care, your kids will avoid hamming like the plague, so it isn't easy. The trouble is you have to be smarter than they are. Also, they have full time to devote to frustrating you and you only have part time to con them. Any helpful hints?

If you are able to get by their guard and get 'em interested in hamming you'll have done them the best favor you could. They'll be on the road toward learning about technology and that will quickly separate them from the kids who will never even have a chance at making it beyond winning a state megabucks lottery.

If it's too late to con your own kids, perhaps you can lay some traps for your grandchildren. Or get to work in a local school and sow your seeds. You won't get much thanks and you won't get a nickel, but if there's a ledger up there, you're going to find some gold stars on it when you get your Silent Key certificate. I think there's a ledger.

So I Screwed Up . . . What's New?

I was just sending in a classified ad to the *Mensa Bulletin* to see if I could suck some high IQ youngsters into our hobby via *Radio Fun*. That got me to thinking . . . always a dangerous situation.

Five of us first members of Mensa in America got together in 1960 and formed American Mensa. I volunteered to be the secretary since I was just starting *73* and thus had a Ditto machine to print meeting notices and the addressing equipment to maintain the mailing list.

A couple years ago a reader claimed I wasn't really a founder of Mensa, but the official Mensa history printed last year finally set the record straight. I'm not sure I can claim much credit . . . I was in the right place at the right time . . . and more of a doer than the others at the meeting.

Where I screwed up, in retrospect, was in not taking the bull by the horns and running with the organization. I let my first wife convince me that I had

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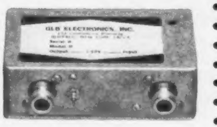

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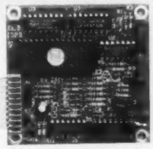

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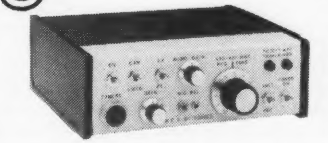

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more than enough to do starting *73*, helping to run the 1960 ARRL Convention in New York and being president of the Porsche Club. Other than damn near killing me . . . twice, I've been trying to remember what good my first wife did for me. I'll keep working on it, there must have been some good in there somewhere.

It just seems a rotten shame to have a high IQ group that has no purpose and is contributing nothing to the world. What a waste! There are chapters all around the world, but they don't even communicate with each other, so even that's a waste. Phooey.

Yes, I was up to here getting *73* started. I was raising hell with every ham author I knew to get construction articles written for the magazine. I was pestering every ham club in the country for subscriptions. I was trying to convince the over 850 ham stores we had then (before ARRL's Incentive Licensing) to sell the magazine. I also had to do all the editing, take the photographs, make all the advertising sales, proof the typesetting, do the page layouts, write and mail thousands of subscription letters, type subscription stencils, print out the subscriber wrappers, wrap 850 bundles for ham stores, bill the advertisers and ham stores, and keep the books. I was a one-man magazine publishing company with just barely enough money to print the first issue, so I had no margin for error.

As the Porsche Club president I kept the membership list, sent out meeting notices, ran the monthly meetings, laid out and ran some rallies they'll never forget, helped with timing trials and ran gymkhanas. I still have the electronic stopwatch I built for the timing trials. Oh yes, I converted a bunch of surplus radios to push-button tune the time standard broadcasts on 3.333, 5.000, 7.335 and 10.000 kHz for our rally check points.

I was also running Radio Bookshop, selling dozens of ham and electronics books by mail, plus a complete line of rally calculators, computers, watches and accessories that I advertised in the car magazines.

Then there was that ARRL Convention. I'll never forget the big banquet where a fathead future ARRL president publicly congratulated himself over the success of the convention . . . while Chet K2EAF and I sat there knowing we had done virtually all the work. We'd sold all the booths to the exhibitors, printed and sent out the posters to ham stores, written and sent out mailings to the Hudson Division members and so on. Oh well, I really shouldn't complain. I learned how to put on a convention and fathead didn't. That experience was priceless for me in 1978 when I organized and ran an enormous microcomputer show in Boston.

On the down side, if I'd gotten more embroiled in Mensa in 1961 I might not have moved to New Hampshire in 1962 . . . one of the smarter moves I've made. Too, Mensa got all messed up with some ridiculous ego clashes in the mid '60s. A few members thought Mensa was really important. Well, we have hams who think working 350 countries is important, so who are we to throw stones? I happen to think being on the DX honor roll is about like owning a Cadillac, one of America's answers to an inferiority complex. No, I've never submitted my cards for DXCC. I've never even been a fanatic about getting cards. If they come, fine. If not, so what? My fun is in talking with people and I particularly enjoy talking to unusual places. I usually call "CQDX" and let 'em call me.

I avoid pile-ups and lists most of the time . . . unless I'm DXpeditioning. Then I have my own system where I use one frequency and knock off contacts faster than any other way I've tried or heard. I work 'em right on down to the mobiles and QRP rigs without making a mess of the band. When I'm home, I prefer talking. When I'm DXpeditioning, I play the instant QSO game.

What would I have done with Mensa if I'd taken it over? Well, first of all, I'd have established some goals for it . . . a mission. Being the exclusive snob group it's become wouldn't have been on the list. When I've mentioned Mensa in my editorials before, I've always pointed out for the jealous—who reactively hate anyone smart or rich—that being smart doesn't really mean much. There's no correlation between IQ and success. It mostly means they can do well on IQ tests. Big deal.

Individual high IQ people people seem to be born with a better brain than others. Alas, that doesn't mean they know more. Indeed, think of your brain as a super computer, for that's what it is. You should know enough about computers by now to know that the hardware, no matter how wonderful, is completely useless without good software. Programming. Well, programming is what your parents, family, friends and teachers put in. But the hardware and software only provide you with an operating system; you still can't do anything with it without data. We get data through TV, books, magazines, and through everyday living. Where so many high IQ people fall short is in their early programming, their lack of data, and their having a whole bunch of bogus data screwing things up. Garbage in, garbage out, in computer terms.

Sure, we learn things. We pick up all sorts of data. But how can we know what is true and what is garbage . . . like sitcoms, soaps and sports? My solution to that is to get a high IQ group together and let the law of averages limit the worst of the bad data. This is where I think Mensa had a great potential. The very diversity of experience, data and programming would tend to cancel out much of the garbage.

So, if I'd have run Mensa I'd have organized conferences aimed to help solve government and industry problems. Even 20 high IQ people with 20 backgrounds and 20 fields of expertise would be one heck of a think-tank resource. And, unlike our commercial think tanks, it wouldn't have to make money.

What use is there of our having a bunch of smart people if we don't use them to help us solve problems? They're sure not going to go into politics . . . they're too smart for that. Heck, if we gave Mensans something creative to do we might even attract more successful high IQ people to the organization. As it is, a minuscule percentage of Mensans are outstandingly successful. Outside of Don Peterson, who was recently canned as president of Ford, I can't think of any successful members Mensa can brag about.

So I screwed up . . . too involved with temporary expediency to see the long-term picture. But, who knows, I might have succumbed to the usual Mensa hubris and rushed out to buy Bakker's Heritage Park and rename it Brainland.

You know, it doesn't take Mensan brains for a group to do a good job of tackling problems. You might want to try it with your ham club and see for yourself. Sure, you'll have some hams with strongly held opinions. That's when they've come to conclusions without positive knowledge. Some subjects are too ineffable to allow rational thought, such as religion and politics.

But it might be fun to pose some typical ham problems to the group and see how well they do in coming up with creative answers. Like what to do about the mess on 14.313 . . . or how to chill K1MAN cluttering up our bands with endless self-serving and even commercial, bulletin broadcasts. Or how your club can help get amateur radio growth going again. Or even how to get more local hams interested in your club.

Let me know how you make out. I think you'll be surprised.

Of course, instead of solving problems, you may end up with sessions like the McLaughlin Group on public television. I enjoy their opinionated approach, their grasp of complex problems, and their inability to even come close on their predictions.

Now The ULFs?

Some scientists have been having considerable success in predicting earthquakes by monitoring the ultra-low frequencies, down below one hertz. This sounds (?) like something some *73* readers might like to have a go at.

Building electromagnetic field detectors for the 0–1 hertz band certainly presents an interesting challenge. Some of the strongest signals seem to peak around 0.1 Hz. Let's see what you can come up with. Maybe we'll need a ULF column, if you start opening this band.

Dayton '91

Too bad if you missed out. The Dayton Hamvention is definitely the world's biggest ham toy store, and everything at a discount! It's two-and-a-half days long, and even so there's no way to see everything. By Saturday morning they had over 33,000 signed in. The huge Hara Arena parking lots and the fields around them as far as you could see were packed solid with cars, vans, pickups, RVs and campers, all bristling with antennas.

You see, they come in convoys from all over the country, each happily gabbing away on their own convoy channel . . . oddly like CBers. A modern version of the old Conestoga wagon trains that crossed the same plains 150 years ago. Instead of Indian arrows sticking out of the wagons, now it's antennas.

I'm not talking one or two, I'm talking mobile antenna farms that would make an AWACS plane envious. Some of them had to have had serious problems with overpasses. These convoys must have wiped out TV reception for whole towns as they passed through.

Imagine, if you will, 35,000 hams, all with at least one HT on their belt, all with their squelch breaking every few seconds. Many had two, three or even four HTs, one for each band so they wouldn't miss out on any bargains their convoy pals might find.

"Hey, here's a guy selling fax machines for $300! Brand new!" "Wait'll you see the Mac software I've found over here." Hams were excitedly carting boxes back to their cars all weekend. With 530 booths inside the arena and 2,276 flea market spaces, now how can anyone do a decent job of checking all that in the only 1,260 minutes the Hamvention is open? Well, 35,000 hams sure tried!

If you try to see 'em all, that means you've got to manage an average of 27 seconds per booth or flea market area . . . and that doesn't count any time waiting on the chow or portapotty lines. That doesn't even allow for any time spent attending any of the 55 forums . . . and they're one of the main reasons many drive or fly all that way.

They had forums for packet, AMSAT, county hunters, antennas, home-brewing, contests, Collins users, ARES, weather satellites, MARS, VHF, repeater coordination, OSSBN, 10/10, FCC, SSTV, Firebirds, SPAM, DX, Red Cross, ATV, bicycle hams, QRP, ARRL, scanners, and SWLs. There were forums on getting new hams, on recruiting kids, and many more technical forums.

Even K1MAN, obviously not totally satisfied with broadcasting on all bands day and night with his endless "bulletins," had a 90-minute forum. Oh darn, I forgot to go to that one!

Yes, there was an Uncle Wayne forum where I tried to keep a packed room awake and chuckling at our collective misfortunes. Alas, as usual it was like a sauna.

The most exciting part of the Hamvention for me is seeing the new equipment being exhibited. Much of the new gear is so complex that it takes an expert several minutes just to cover the basics. It made me wish there was some way to get across all this information in a product review. But there's so much to tell that we're talking about book-length reviews. You really have to see a lot of this stuff yourself and talk with the people who have designed it.

While another ham rag devotes its editorials to complaints about hamfest food, I still look forward to the Hamvention BBQ sandwich. Love it! The Hamvention committee sure is cheap with their refreshments for the exhibitors. There's some coffee and a supply of doughnuts which runs out in minutes. That's it. No cold drinks. No sandwiches. They are considerate in providing a special room where exhibitors can buy lunch instead of waiting on incredibly long lines. But they don't reckon with us notoriously tight Yankees. So I grumblingly shell out and buy a BBQ sandwich which I split with Sherry. Okay, I'm cheap . . . would you rather I increased the *73* cover price and went first class? Please advise.

The *73* Booth

We had the premiere issue of *Radio Fun* available and got completely cleaned out of the over 3,000 copies we brought. We announced this new publication aimed at newcomers to the hobby in the April *73* and have been getting an average of 100 subscriptions a day ever since. We had 'em lined up at the booth to subscribe.

We had another line of customers signing up for *73* subscriptions. Many were furious at *CQ* for putting *Ham Radio* out of business and then, despite promises to change, continuing as a contest magazine. We sold more *73* subs this year than we've ever sold in the 30 years I've been exhibiting.

I was delighted, too, by the parade of well-wishers who said they enjoy my editorials and agree with them. That's a change from the past, where many claimed they enjoyed 'em, but didn't always agree with me. And I don't think *I've* changed!

A gratifying number of readers stopped to thank me for getting them to (a) stop smoking, (b) take off weight, and (c) go into business and have fun making money.

The *73* crew was even more excited to hear from one advertiser after another about how happy they are with the sales their ads are providing. I'm used to hearing that we outsell *CQ*, but it's been a while since we've outsold *QST* consistently. We've got to watch out or *73* might start getting fat again, like it was a few years ago.

We did make sure that potential *Radio Fun* advertisers got a sample copy of the premiere issue. Many said they wished they'd been in it and wanted to be sure not to miss out when we go monthly starting in September. Since newcomers are responsible for a high percentage of ham sales, this makes sense.

The Ham of the Year!

Johnny Johnston W3BE, our liaison at the FCC, was awarded the coveted Hamvention award this year. An excellent choice. Johnny had some good news for us . . . and some bad. On the bright side of the ledger was the success of the no-code license. This has definitely increased our input of new hams. Indeed, many stopped by the *73* booth to thank me for pushing for the no-code license for the last 32 years.

Continued on page 73

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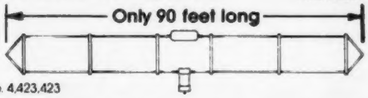

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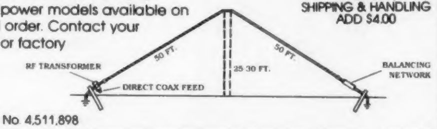

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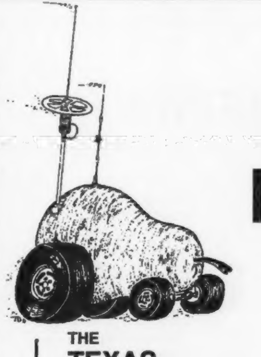

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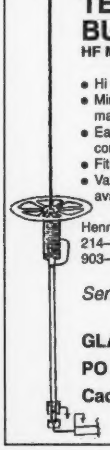

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Continued from page 71

Talk about "never say die"! They also subscribed to *Radio Fun*.

The idea of *Radio Fun*, in case you've just emerged from hibernation, is to make sure that as high a percentage as possible of new licensees actually get on the air and start having fun. It'll be explaining how to get involved with packet, satellites, DXing, contests, certificate hunting, UHF, repeaters, transmitter hunting, ATV and so on. It'll also be running technical articles aimed at helping newcomers understand what this radio stuff is all about. And it'll be reviewing every kit we can get our hands on. Carole Perry WB2MGP has a column for the newcomer. Gordon West WB6NOA shows you how to upgrade.

We also brought along a big stack of the CDs my three record companies have been producing . . . and sold right out. I was pleased to find so many *CD Review* readers stopping by to say hello and keep up the good work. We will.

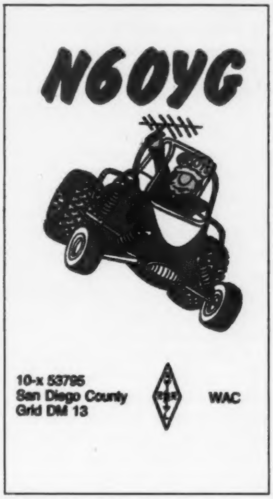
The excitement over the new no-coders was mitigated by Johnny Johnston's mentioning that around 20,000 amateurs have historically been lost each year through winning their Silent Key Award or lack of interest. The 10-year licenses have obscured this loss, giving the deceptive appearance that we've been gaining in numbers. Indeed, at that rate our supposed 500,000 total licensees could eventually be as much as 200,000 overstated. This is what W5YI has been telling us in his newsletter . . . and what the ARRL has been determined to ignore with their inflated numbers. The sorry fact seems to be that even with the new no-code licensing spree, we're only growing at about 1.2% per year . . . one-tenth the growth we averaged in the 1945–1964 era . . . before Incentive Licensing hit.

I was heartened by a parade of readers stopping by the booth to tell me about their successes in getting youngsters into the hobby. I said the same thing to all of them . . . send me some pictures. Prove it. I saw a few more youngsters at the Hamvention this year than previously, but they were still a rare sight . . . nothing like 30 years ago, when kids were all over the place.

You know, I hear all this baloney about how many hams are interested in the code, yet even at the largest hamfest in the world (outside of Japan), there wasn't a code speed contest. They used to be a big feature at virtually every hamfest. I'll tell you what, I'll have *73* print some certificates if your club will put on contests at your hamfests. Let's start making it a matter of pride to be good at copying code. You'll probably want certificates for 20, 30, 40, 50 and 60 wpm. Think that'll hold you?

You say you want practice tapes? Give me a break! Get a computer and do it that way and get off my back.

During my talk, I did mention how easy it is to learn the code at any speed you want. The ensuing rush wiped us out of our 20 wpm tapes at the booth. We also sold out of our $99 videos on how to generate an extra million in sales with PR. We're still getting raves on that. It's even being used by some M.B.A. schools.



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

It was fun, too, meeting so many old friends. Walt WA6BMG, who I used to talk with in 1938 in Brooklyn, where he was W2LBF, was there. Arne SM5AM, who showed me around Stockholm and Aland (OH0) back in 1966, was there and looking healthy. Norm W2JUP, who took over the RTTY column in *CQ* when I became the editor, was helping AEA show their new stuff. I've been promised an article on their new gear, which is amazing. Friends from South Africa, Kenya, and all over Europe were there and said hello. Jack Aviv WA2KNC, my first *73* employee (1961), was there.

Maybe you'll want to think about joining one of the convoys heading to Dayton next year.

Radio Fun

The subscriptions to *Radio Fun* have been pouring in. That's pretty good considering that it was just announced.

The concept has caught on. The idea of stressing the fun of amateur radio as a follow-on for the new no-code license is timely. We do have a fantastic hobby, one that can be enormous fun. Often we get all involved in some kind of aggravation and forget that fun is what amateur radio is all about . . . the passion which makes it so exciting.

No one is paying us to do this. We're not only spending great gobs of our time on our hobby, but we're spending our own money for the equipment. We provide public service only partly in repayment for the incredibly valuable frequencies we get to use. Mostly we do public service because we enjoy it. It gives us a sense of having done something positive. It gives us a sense of our own value and importance. It gives us an opportunity to do something worthwhile for the common good. It helps give us a feeling that we've contributed to the world . . . and that feels good . . . it's fun.

Somehow, the harder we work at something personal like this, the more fun we have. I treasure the hundreds of times I stayed up most of the night building equipment. But not only did I have a ball doing it, I also laid the foundation for a lifetime of ham publishing.

In 1946 I built one of the first FM modulators into my Meissner Signal Shifter and helped W2GDG pioneer narrowband FM. And I loved every minute of it.

I built all kinds of elaborate RTTY equipment and had so much fun that I had no choice but to start a magazine on the subject to try and inveigle others into sharing the fun I was having. I love to share my enjoyment with others. That's one of the reasons I have so much fun with *CD Review*, my music magazine. I'm getting tens of thousands of people introduced to classical music, to ragtime, and other kinds of music they might otherwise miss.

Okay, goody-goody for me, but how about you? What's the most fun you've had in amateur radio? And why don't you sit down and write about it so we can pass along your story to the *Radio Fun* readers? Have you mixed hamming with sports car rallies? With hot air ballooning? With travel? Why the heck not? I don't see any anchor tied to your ankle. I've done all those things and I can promise you you'll never forget the fun you'll have.

How about building ham gear and test equipment from kits? I've built so many Heathkits I've stopped counting. Old-timers will remember Eico kits. Our Incentive Licensing disaster killed Eico. There are plenty of kits around today that are fun to build . . . and more are coming. With the enthusiasm we can build via *Radio Fun* I'll bet we can get hundreds more parts kits on the market. If you've built a kit you think others would enjoy, let's hear from you! Share your fun the way I do.

How about some ideas on hidden transmitter hunts? Our young newcomers will have a great time if we can get them involved with those. It won't be a bad idea to shake some of the rust off old-timers too. Some of you old coots are about as active as the Tin Man after a rainstorm.

Say, coots, when you find a youngster who is a likely ham prospect, you could spring the $10 for a subscription to *Radio Fun*, right? It's bad enough being an old curmudgeon without being a cheap old curmudgeon to boot.

The Premiere Issue

The first issue of *Radio Fun* is out. We somehow managed to get it out in time for Dayton. I was very impressed with the advertising support we got, sight unseen. I expect you to subscribe and buy at least one piece of gear from each advertiser. Fair is fair, right? That's the least you can do.

We'll be starting the regular monthly publication in September. That'll give you some time to send in articles aimed at making amateur radio more fun—particularly for newcomers. It'll give the ham industry some time to get horsed around to advertising so we can have a big fat publication, packed with kit reviews, simple electronic and radio theory to help you understand what's in those black boxes you've been talking into. You do want to understand how electrons work, don't you?

I expect we'll be seeing some of Editor Bill WB8ELK Brown's fascinating stuff. He came into the office today with a tiny TV transmitter. The darned thing, sent in by KC6CCC, was about 1.5" square and had an exciter on 434 MHz, plus a 100 milliwatt amplifier and modulator, all run by a tiny 9V flashlight battery. He'll no doubt be sending it up with a miniature camera in one of his balloons. Ever tried that? The balloons can get up to 100,000 feet and be copied up to 400 miles away! You just put your TV antenna on your cable converter and tune to channel 60. Voila!

Only $10?
How Is That Possible These Days?

Radio Fun is a no-frills publication. We're doing it in a tabloid format, like your local shopper. We want to get information out to help newcomers . . . to make hamming more fun for everyone. This is a labor of love by the *73* staff. We haven't added any extra people. As soon as you add staff and use slick paper, the cost skyrockets and then we have to charge $20 a year just to break even. We'll keep *Radio Fun* at $10 as long as we can, but if it gets too fat we'll have to add some editors and up the subscription price.

Remember too, your $10 is subsidizing 20,000 copies of *Radio Fun* which are going to newcomers to help them get started in our hobby. This is our opportunity to start them off right and help them avoid some of the miseries we went through at first. It's difficult for old-timers to remember how dumb they were at first . . . and how much they needed help.

I think *Radio Fun* may get old-timers to think in terms of elmering youngsters and perhaps even getting down on the Novice bands to lend a hand . . . after turning off their linears. We'll see.

Meanwhile we need all the support we can get . . . in the way of subscriptions, advertising, and enthusiastic articles on exciting ham activities and kit evaluations. ■

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73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

Of much interest in this month's column is an informative report from Tim Chen BV2A of Taiwan. In conjunction with that, I am including portions of a recent article from The Wall Street Journal, *reporting that Taiwan has ended its civil war with mainland China and recognizes the Beijing leadership.*

"QSL to Box 88, Moscow." How many of you have ever wondered what Box 88 is really like? Now you will find out, thanks to Ron Gang 4X1MK.

Onward to the good news!—Arnie, N1BAC.

ROUNDUP

Switzerland From a message by the ITU Secretary-General, Pekka Tarjanne, about the 1991 World Telecommunication Day which occurred on May 17, 1991:

This year, the theme of World Communication Day is a subject close to the hearts of every one of us: Ensuring the safety of human life. Due to the contributions in this area made by telecommunications, the latter was celebrated as part of the Natural Disaster Prevention Decade proclaimed by the United Nations General Assembly.

The first commercial radio telegraph services were introduced at the end of the 19th century. This new communications medium was a godsend to mariners in distress. Yet, if lives were to be saved, the message had to be heard. For this reason, an international agreement, signed in Berlin in 1906, specified that "Wireless telegraph stations must give absolute priority to receiving and replying to distress signals from ships and take all appropriate action." This same agreement included the international adoption of the SOS signal. The International Telecommunication Union introduced other safety measures: Ships should have a radio set on board and special radio frequencies were reserved for distress signals.

Over the coming decade, the Global Maritime Distress and Safety System will be brought into use. This new system, developed by the International Maritime Organization in collaboration with the ITU and other bodies, will provide a new degree of safety to seafarers.

Transportable satellite earth stations can be used for emergency communications and, coupled with land-based facilities, provide a vital tool for relief operations. However, much remains to be done to ensure the fast transborder movement of such telecommunications equipment to disaster sites. With this in mind, the ITU, working with other concerned organizations, has proposed a project to facilitate the speedy movement and customs clearance of telecommunications equipment for disaster use, which could, in due course, lead to an international convention. Also, cellular technology can prove to be a solution to the difficult problem of providing telecommunications outside major urban areas.

It is, indeed, my ambition to speed up the arrival of relief to anyone in danger, wherever disasters may strike or, more generally, in need of assistance in rural and remote areas.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel
PACKET: 4X1MK@4Z4SV.ISR.EU

We were greatly relieved with the cessation of the hostilities in the Gulf. It spelled for us here in 4X-land the end of destruction and injury caused, not to mention the disruption of normal life for the month and a half of Operation Desert Storm. The Civil Defense Authorities gave the O.K. to put the gas masks away and open up the rooms (and some hamshacks as well!) that each household had hermetically sealed. Nightlife in the big cities has commenced once again.

The Ministry of Communications issued a special letter of thanks to the Israel Amateur Radio Club in recognition of the public service provided by the amateur community during the crises. Hopefully now diplomacy will take precedence, and we will be able to see the end of the lack of peace accords in the region. The time is ripe, and judging by the trends in the world, that we have noted in this column over the past years, it appears that we are nearing a new age where enlightenment will banish the darkness. Let us all do our part in our own small way, and see to it that our international contacts via ham radio will contribute to the good will!

A Visit to Box 88, Moscow. Early last March, Dr. Oded Schremer 4X4SO was invited to the Soviet Union for a scientific conference. Before leaving for Moscow, Oded got on the air and contacted a few Russian hams, who invited him to visit the Central Radio Club. Upon arriving, Oded saw that his schedule gave him the mornings off. One morning, after calling a number given him for the club, he set off for a visit, accompanied by his interpreter. The club was located an hour and a half from the center of Moscow.

The State-run and supported Central Radio Club is housed in a two-story building somewhat resembling a school. A few rooms house the world famous P.O. Box 88 Moscow QSL bureau, whose six full-time employees sort many, many millions of QSL cards each year! Another room holds a large ham station which normally has a full-time operator who, unfortunately, wasn't there that day.

There is yet another section, full of test equipment and staff to help out those building or repairing their own gear. It should be pointed out that due to economics, imported commercial gear is not available in the USSR, thus almost all stations are homemade.

On the first floor there is an exhibition of all kinds of radio equipment, and the halls of the building are decorated with color posters of sports people and radio amateurs. All in all, the Central Radio Club of Moscow is a building buzzing with activity from early in the morning to late at night.

Nocolai UA3AF, who heads up the operation, showed Oded a beautiful full-color magazine that they put out. Oded told them that he was really thrilled to be inside "Box 88 Moscow," that address being world famous, known to virtually every radio amateur on the globe. This really made the people on hand very proud, as it turns out that they are seldom ever visited by hams from outside of the USSR, and had no idea of their image abroad.

Photo A. Oded Schremer 4X4SO with QSL sorters at "Box 88 Moscow"—the Central Radio Club.

Indeed, the hams at the Central Radio Club had never met anyone from Israel before, and 4X4SO's visit was a big event! Until April 1988 (just 3 short years ago) hams in the Soviet Union were prohibited to contact Israel. They told Oded that this ban had caused them much grief, as they had heard us on the air, and had always wanted to make contact. Life in the USSR has changed since then, with new openness and freedom of expression. Oded parted with his hosts at Box 88 after taking photographs as a souvenir of this historic meeting, having been most warmly received.

Looking out of the car window, as any keen-eyed ham should, Oded spotted a number of beams and quads on the rooftops, but unfortunately did not have the time to visit any hams in their homes. Now, for 4X4SO, Post Office Box 88 Moscow means much more that just an address for QSLs. Hams visiting Moscow would do well if they paid a visit to the Central Radio Club there.

NEW ZEALAND

Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

Hello to all! Just a quick note to advise you that the NZART Hastings Branch, ZL2BEI, is organizing another 160m event to encourage hams to "Have a Go" on 160 meters, and maybe meet new fellow hams who are 160 enthusiasts.

The frequency is 1850 kHz, ±10 kHz, LSB or CW, 0800 to 1200 UTC, 21–22 June 1991. There will be as many ZL stations available as possible.

You may remember that the Hastings Branch ran one of these events last year in October. It generated so much interest that this one has been put together, and we hope that this news reaches you in time to participate.

If the interest continues, the Hastings Branch of the NZART will organize another weekend event for next March in 1992. 73, Des ZL2VR.

SWEDEN

Rune Wande SM0COP
Frejavagen 10
S-155 00 Nykvarn
Sweden

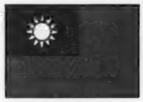
The European CEPT License

Some years ago, 26 European Telecommunication Authorities agreed upon simplifying the procedures for radio amateur operators to use their ham equipment while visiting CEPT member countries. The result is that no visitor license has to be applied for. You only bring your home country license that states which class of CEPT license you have. There are two classes, Class 1 with both HF and VHF privileges, and Class 2 for VHF (no code required). Last year five East European countries indicated that they will apply for membership in the CEPT community.

So far, 17 CEPT countries have implemented the recommendation for the so-called CEPT license, recommendation T/R 61-01. These countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Liechtenstein, Luxembourg, Monaco, The Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom.

The identification for using the CEPT license is somewhat cumbersome. Visiting Sweden, a CEPT ham MUST identify as follows: SM/home call/P for portable or /M for mobile. Either /P or /M MUST ALWAYS follow the call. In most countries, it is not necessary to include the number for the call area.

Hams from other countries must, however, apply for a regular visitor license. In the past, Sweden has required a written statement by the local police of the applicant's "good conduct" to be included with the application for a visitor's license. This requirement was deleted on January 1, 1991.



TAIWAN
REPUBLIC OF CHINA

Tim Chen BV2A
PO Box 30-547
Taipei
Republic of China

Although I have not reported in this column for a considerable length of time, I believe that our recent developments in Taiwan may be of much interest.

We have made great strides in amateur radio activities. Local government has given the public the qualification examinations three times: in 1984, 1988, and 1990. As of this date there are more than 300 licensed stations and about 620 ham operators scattered on this island. The majority of the stations are in the second district, BV2, which belongs to Taipei City and Taipei County, with BV4 and BV7 next, and only a few stations located in other districts—BV1, BV3, BV5, BV6, and BV8. BV9 is for offshore islands, and BV0 is reserved for special occasions and DXpeditions. The indications are that the number of amateur radio candidates is increasing rapidly. The best guess is that 2,000 people will participate in the next examination, which hopefully will take place in June 1991.

It will be quite a burden to the authorities to handle this sudden surge in the ham population. They will probably have to revise the rules and administrative matters, as well as develop an examination pool.

Presently there are a great number of young men and women (CBers) who are enthusiastically, though illegally, using V/UHF operations each day on 144 and 430 MHz. The chaos on the air is terrible. How to lead them a dance [control the situation] is a government problem all hams are concerned about.

In spite of the adverse circumstances, hams had an experimental test with Japan last July with VHF and UHF QSOs at three different positions on mountains at 600, 2,000, and 3,200 feet above sea level. The CBers were well-convinced of amateur radio communications being worthwhile. We hope that more and more CBers will change their status and become good hams.

The booming situation makes it necessary for us to set up an independent society strictly of, by, and for the radio amateurs. It will not only assist local hams to further progress, but also foster the good relationship with all the amateur fraternities in the world. We assure that the increase of BV stations will be easy to access on the air in the future. The general assembly of the independent society, temporarily named the Chinese Taipei Amateur Radio League, was scheduled to have its inaugural ceremony on March 10, 1991. Very soon it will apply for membership in the International Amateur Radio Union (IARU).

At this moment there is no change in the regulation that we do not grant licenses to individual visitors. A DXpedition group is usually welcomed and given a special callsign, but the group has to submit an application at least two months in advance for approval. The Post and Telecommunications Department, M.O.C. No. 2 Chang Sha Street, Taipei, Taiwan, ROC is the authority. And if we can be of any service to you, please contact the Chinese Taipei Amateur Radio League (CTARL) at 3F, No. 19, Lane 312, Pa Te Road, 2nd Section, Taipei, R.O.C., or P.O. Box 93, Taipei, Tel. (02) 711-4652, FAX (02) 771-2378. 73, Tim Chen BV2A.

From *The Wall Street Journal*, dateline Taipei, May 1, 1991: After more than 60 years, China's civil war has officially ended, at least in Taiwan's eyes. Taiwan President Lee Teng-hui declared the termination of a period of emergency rule imposed just before the communists took control of China in the late 1940s. The emergency froze in place a state of war with the communists that, despite some periods of cooperation, extended back to the late 1920s. Until now, the Kuomintang government in Taipei officially viewed the Beijing government as rebels who had usurped the KMT's rightful authority to rule mainland China.

President Lee's proclamation, which came as a quasi-official Taiwan delegation visited Beijing for the first wide-ranging talks ever held with mainland officials, represents another important step in the gradual relaxation of tensions across the Taiwan straits.

Hamsats

Continued from page 54

The Soviet Connection

A verified two-way exchange of callsigns was made between Ken KB5AWP and Musa Manarov U2MIR. While mobile-to-mobile contacts are common, space-mobile to space-mobile ham contacts have only begun recently. Ken on *Atlantis* and Musa on *Mir*, the Soviet space station, were the first. The low orbits of the two vehicles make *Mir*/shuttle line-of-sight possibilities uncommon, but for this mission it worked. This time voice was used, but packet could be tried on another flight.

Educational Activities

One of the most successful aspects of SAREX on STS-37 was the communications with educational institutions. The astronauts answered questions from children in many schools. Often the shuttle was not over an area at the correct time for school hours. This necessitated the use of phone links and bridges to hams with direct access to the shuttle at specific times.

In Australia, Graham Ratcliff VK5AGR provided links while Junior de Castro PY2BJO took over from Brazil. The links and phone bridges worked for STS-35, and did the job again for STS-37.

The school connections during April 6 included 10 educational groups from Texas, Ohio, Illinois, California, Pennsylvania, and Oklahoma. Many others listened to the two-way conversations through the link system created by the SAREX supporters. SAREX brought the space program into many classrooms in several countries during the flight.

SAREX in the Future

Enormous effort has been required to make SAREX a reality. Hundreds of hams have been involved with parts of the program. Organizers and promoters like Bill Tynan W3XO and Roy Neal K6DUE have put in long hours to find the support needed to make SAREX happen. Roy has announced that new video tapes documenting the program will be available when school starts this fall. Lou McFadin W5DID is perhaps the key ham responsible for flight gear. Several hundred documents and drawings have been required by NASA before allowing the ham equipment in the shuttle. Lou and his group fulfilled the requirements.

It is hoped that all the effort to operate SAREX on four flights will now begin to pay off. Rather than being classed as an additional experiment each time, SAREX gear could be available for use by any ham/astronaut requesting the system for a specific mission.

The next opportunity for SAREX may be later this year or early in 1992. One astronaut has expressed an interest, and others may be joining the ranks of amateur radio very soon. An intensive weekend ham radio course is in the planning stage for a group of current and future astronauts. While STS-35 stressed packet communications and STS-37 promoted educational efforts, a more "standard" ham-QSO activity is expected for the next chance. An all-ham crew may be a first this time, but it may be quite common in a few years.

Number 24 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Hamhelp SIG. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 525–4438). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Thank you for your cooperation.

I would like to hear from hams that operated club station KJ6DO on Johnson Island. History, information, QSL card, or pictures would greatly be appreciated. *Chuck Bowers KJ6DO, 837 Ridgeview Ct., Oakdale CA 95361.*

WANTED: Compact disk to learn and improve speed of CW. *Doug Franklin VE3EYE, #77 Glasgow St., Conestogo, Ontario, Canada N0B 1N0.*

I urgently need schematics and manual for a Santec ST-142 handie-talkie, to repair mine by the time my license arrives. Will pay for copies. Thanks. *Jeno F. Racz, 850 September Drive, Cupertino CA 95014.*

I am looking for software and connection info (such as Galfo) to operate an Apple IIc with an MFJ-1224 CW/RTTY interface. *Bruce Danielson WA1WQG, 4 King James Drive, East Lyme CT 06333.*

I need a copy of the schematics or booklets on the SBE 33, the Hallicrafters SX-101, and HT-34. If you know of any upgrades or improvements to these items, I would appreciate it. *Paul Christie ex-K2UKT, 208–27–15th Rd., Bayside NY 11360.*

I need a schematic for a METSAT, model 1500 computer-based weather satellite video scan converter, and connections to Tandy CoCo 64. Will pay for copying and mailing. *William A. Rizzo, P.O. Box 578, Pago Pago, Am. Samoa 96799.*

I am fourteen-years-old, and have just started working towards my Novice ticket. I would like to thank all the staff at *73* for the great articles that gave me the inspiration to get my license.

I have a problem with getting radio equipment, though, and would like to ask all the hams out there if they have any extra stuff just collecting dust that could get me started towards my Extra license. I would also like to ask any ham in the Modesto, California, area if they have any interest in helping me get my Novice license. I'm having trouble with the code. *Brandon Wilson, 920 Briggs Ave., Modesto CA 95351.*

Need instruction manual or copy for Drake MN-2000 antenna tuner. Need overall chassis schematic and service manual for Tempo/Uniden 2020 transceiver. Willing to pay copy and postage costs. *Evan Rolek K9SQG, 2053 Mohave Dr., Dayton OH 45431. (513) 426–1986.*

Number 25 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
P.O. Box 131646
Staten Island NY 10313-0006

An Uplifting Experience

"Now, class, for today's lesson we're going to discuss how to QSL to our terrestrial QSO with the astroham, and plan our unit on SAREX and the STS-37 mission in reference to the deployment of the Gamma Ray Observatory." Who would ever have believed a few years ago that this could ever be an authentic opening statement for a teacher to make to a 6th grade class, or that the youngsters would understand and respond eagerly to it?

Of all the exciting adventures that teaching amateur radio in a classroom has led me to, none excites me as much as our involvement with the space program. The remarkable thing about this topic is that it is so dynamic. Intrinsic in the material are new and creative ways to introduce space studies to children.

Therefore, I jumped at the chance to accept an invitation by the Johnson Space Center Amateur Radio Club to participate at the SAREX Booth of the National High School Science Teachers Convention in Houston, Texas, this past March. I knew that I'd enjoy talking about amateur radio in the classroom at the convention; I just had no idea how momentous a trip this would turn out to be.

Rosalie White WA1STO, head of the ARRL Education Department, and I had a wonderful time at the booth with our hosts John WD5EEV and Karen Nickel WD5EEU, Dale Martin KG5U, and Ruth Ann Barret KB5MOT. Hundreds of science teachers stopped by the booth to learn more about SAREX (Shuttle Amateur Radio EXperiment) and how it can be used to motivate youngsters in a classroom.

During my visit to the Johnson Space Center, I was privileged to address the amateur radio club there and share some of my classroom experiences with them.

The highlight of the whole week came when John took us to the WETF (Weightless Environment Training Facility) at the space center to meet with mission specialist Jay Apt N5QWL. Jay had made a contact with my kids on the CQ All Schools Net last October, so you might think I wouldn't be unduly overwhelmed at the prospect of meeting with him in person. You'd be wrong. I was absolutely awestruck by what I got to see and do that morning. Jay was warm and gracious and even invited me onto the diving platform for a picture to show the children. He'll never know what an impact those photos had in my school. Children with all different backgrounds and abilities were enchanted with the album I put on display. They identified with my experiences, and related to the feeling of pride for the astronauts' work, that I conveyed to them.

As I watched Jay being submerged into the pool to practice new spacewalk equipment and techniques, I thought about what phenomenal courage and dedication it takes to be an astronaut. Too many of us have become jaded about space shuttle travel, and we tend to take for granted the very special people who help make it seem easy.

At this point, pilot Ken Cameron KB5AWP joined us at the WETF. He too was gracious enough to spend time and respond to questions that I knew the children would love to have me ask. He gave me an autographed photo of the STS-37 crew which is presently displayed in the showcase of our school's lobby.

The upcoming launch of the *Atlantis* on April 5 was starting to take on a very personal meaning to me. Personal contact with these extraordinary people either in person or on a radio has to heighten interest even in the most blasé of children. That's why one of the goals of SAREX is to encourage public participation in the space program; another is to support educational opportunities offered by amateur radio voice and digital communications.

Photo B. Astronaut Jay Apt N5QWL welcomes Carole Perry WB2MGP on board the diving platform at the WETF.

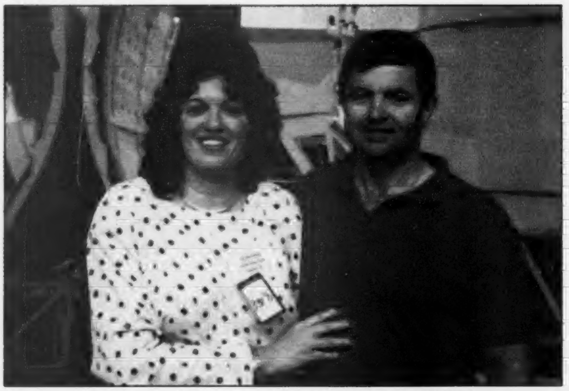


Photo C. Carole with Atlantis *pilot Ken Cameron KB5AWP.*

Photo D. A view from the press site of the Kennedy Space Center. Notice the countdown clock.

Photo A. Carole Perry WB2MGP and John Nickel WD5EEV have fun working W5RRR at the Johnson Space Center.

Because all five of the astronauts on STS-37 are hams, and because of my meeting two of them in person, I decided to accept an invitation by *73 Magazine* to see the launch of the *Atlantis* at the Kennedy Space Center in Florida.

I took the opportunity to attend various press briefings before the launch. Reporters were given the chance to ask in-depth questions of experts involved with the development of the Gamma Ray Observatory from TRW, and to attend conferences about SAREX, biomedical research, and structural information relating to the mission.

Lift-Off!

There aren't many events I consider worth getting up at 4 a.m. to attend, but the lift-off of the *Atlantis* surpassed my wildest expectations. Dawn broke as I approached the Kennedy Space Center that morning—along with a downpour of rain. There was cloud cover all morning, and it was touch and go up until the planned pause with nine minutes left in the countdown. Launch officials switched runway-approach directions for *Atlantis* in the event it had to make an emergency landing at Kennedy Space Center. The shuttle's three main engines and two booster rockets ignited at 9:22 a.m.—four minutes behind schedule. With a fiery leap off launch pad 39B, *Atlantis* zoomed through the low cloud cover and soared eastward over the Atlantic Ocean.

Mesmerized, I watched this phenomenal event from the base of the countdown clock at the press site. When I heard the announcement, "We have lift-off of the *Atlantis*," I felt an unparalled surge of pride. As the *Atlantis* disappeared into the clouds, I turned around to see that same "special look" on the faces of the other reporters. Some were teary-eyed, some were applauding and cheering, but everyone was smiling.

In the quiet moments of walking back to my car in the parking lot, I tried to sort out the euphoric feelings and the incredible myriad of stimuli of the last week. The only thing I could think of as I drove out of the space center was that this was one spring break when the *teacher* would have the best "Show and Tell" of anyone in the class.

Space Travel and Communications

The National Air and Space Museum, in collaboration with NASA, has prepared a wonderful book for teachers, called *Discovery*. The following are some ideas for classroom activities, all of which can be adapted to suit your age and ability group.

1. Have students interview an older adult, such as a grandparent, and ask about Neil Armstrong's first steps on the moon on July 20, 1969. Students might ask the adult: "Where were you?" "How did you feel?" Have students tape their interview so it can be shared with the class.
2. Discuss why some astronauts need to wear spacesuits. Have one student trace around another student's body while he or she lies flat on a large piece of paper. Have students design a spacesuit on the tracing, labeling all the different parts of the suit. Remind students not to forget any important items. Then have them color the suit and add their nametags.
3. The *Saturn V* rocket was used to launch the *Apollo* spacecraft. As an art lesson, have the students build small models of the *Saturn V* launch vehicle. Use cardboard tubes for the body, a cone-shaped paper cup for the nose, light cardboard for fins, and pieces of plastic drinking straws for the engines. The students may write a story or play about launching their rockets and what it carried (payload) or helped to launch.
4. One *Skylab* crew spent Christmas in *Skylab*. Form student groups and let them choose a holiday and plan a celebration for a *Skylab* crew. Remind them to think of the small area, limited storage, and weightlessness.

For more information about what resources are available for classroom teachers, contact: The Education Resource Center, Office of Education P-700, National Air and Space Museum, Smithsonian Institution, Washington, D.C. 20560. Tel. (202) 786–2109.

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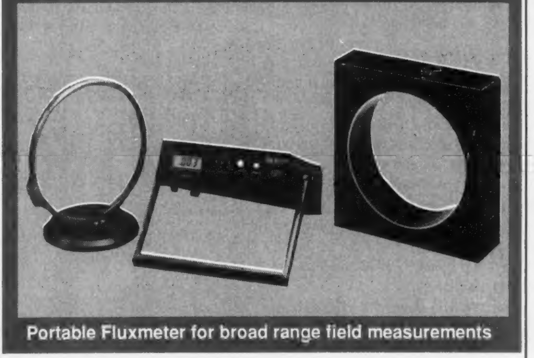

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QRP

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The Last of the HW-9!

I was checking my electronic mail from CompuServe one night and there it was, a note saying Heathkit will be dropping the HW-9. The good *do* die young. I have no idea how many HW-9s have been sold, but they were a very popular QRP radio. After logging off CompuServe, I got somewhat misty-eyed and brought down my little green HW-8. Ah, yes! This is QRP if ever there was.

After finding the power cord and a suitable length of coax with an RCA plug on the end, it was QRP time on 40 meters. But something was wrong. For the life of me, I could not make a single contact with anyone. Off went the cables, and the HW-8 took a trip to the repair bench.

With Heath gear, I always like to go through and check out the alignment. Any trouble areas will easily pop out. In my case, several trouble areas came right up to the surface.

The first problem was with the VFO. It was way off frequency. Heath has a strange way of calibrating the HW-8 that is both time-consuming and hit or miss. Heath wants you to zero beat the output of the VFO to a receiver tuned to 7.0 MHz or 7.250 MHz. You end up moving two VFOs—the HW-8 VFO and the receiver's VFO. This is a real pooper! There's a better way to do it.

Tuning the HW-8

You'll need a frequency counter and some patience. The VFO generates frequencies from 8.645 MHz to 8.895 MHz. A good place to tap the VFO is on the emitter of Q3, the emitter follower, of the VFO. From here you'll be able to see the exact frequency the VFO is running at. Then it's time to play cat and mouse. The VFO must be adjusted to operate properly. Follow the instructions in the manual.

Basically, you move the VFO to one end of the band, adjust trimmer capacitor C302B (the screw adjust on the main VFO capacitor), and move the VFO to the upper end and adjust L9. You keep going back and forth until the zero on the dial and the 250 mark fall exactly on 7.000 MHz and 7.250 MHz, with the band switch in the 7.0 MHz position, of course. With a frequency counter connected to Q3, the values will be 8.645 MHz and 8.895 MHz.

It's easier said than done. No matter how I tried, I could not get the VFO to track 100 percent. The slug in L9 would not turn smoothly enough. It snapped back and forth. I ended up with the high end of the band out of alignment just a tad.

My reasoning is that most of the activity for the HW-8 is on the CW bands, and that that is where the VFO should be most accurate. It works for me.

When working on the HW-8's VFO, be sure to allow ample time, so the VFO can warm up to operating temperature. Use a stable power supply, not dead batteries. After I got the VFO back in line, the second problem came up to bite me: no VFO transmit offset.

When the HW-8 goes to transmit, diode D11 effectively adds capacitor C55 to the VFO, which causes a downward shift to the VFO frequency. This should produce a fixed offset of 750 Hz during transmit. In my HW-8, C55 did in fact get switched into the VFO. Only trouble was, the offset was 3 kHz, not the desired 750 Hz. Useful, but hardly interchangeable. The offender was C55. It changed value. The fix was simple: Replace C55 with a good capacitor. But I went one step further. I tried adding a small value trimmer capacitor in place of C55.

Experiment, Experiment

My thinking was simple: adjust the trimmer capacitor to the offset I wanted. But it didn't work! The trimmer changed the alignment of the VFO. The trimmer was not stable enough to use on the air. All in all, a pooper and a half. Heath's value of 6 pF is a good value to stay with. I ended up using 5 pF and having a 730 Hz offset. Capacitor C55 is kind of hard to get at. I removed the old one and soldered the new one on the trace side of the PC board. Bent down on the board, the capacitor fits quite nicely.

To see how much offset you have during transmit, connect your counter up to the emitter of transistor Q5. Here you'll see the exact operating frequency of the HW-8. During transmit, C55 shifts the transmitter down. You'll see this shift at this test point. As a thought, here would be a good place to add a buffer/amplifier for a digital readout, replacing the analog dial in the HW-8. I can see it now. An LCD display instead of the plastic dial used now.

When I brought out the HW-8, I had to dig up the 2000 ohm headphones required. I found them in a dark corner of the basement. After 15 minutes of use, I remembered why they were in a dark corner of the basement. With this thought, how about some modifications for the HW-8?

The most common mod for the HW-8 is the addition of a small grain-of-wheat bulb behind the meter. It makes a super "on" indicator. Use a small terminal strip to hold the bulb in place. Tap +12 volts from the power switch and use the chassis for negative return. Simple, but really first class.

Building an S-Meter for the HW-8

This modification is simple and easy to build. With easy to come by parts, we can have an S-meter for the HW-8. Granted it's not the best S-meter in the world, but it's an S-meter nonetheless. The circuit consists of nothing more

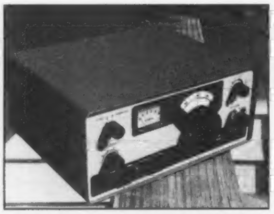

Photo A. The green QRP box, the HW-8, is a solid performer even on today's band.

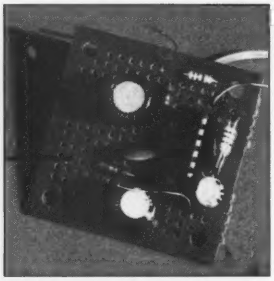

Photo B. The 2 watt audio amplifier assembled on perfboard.

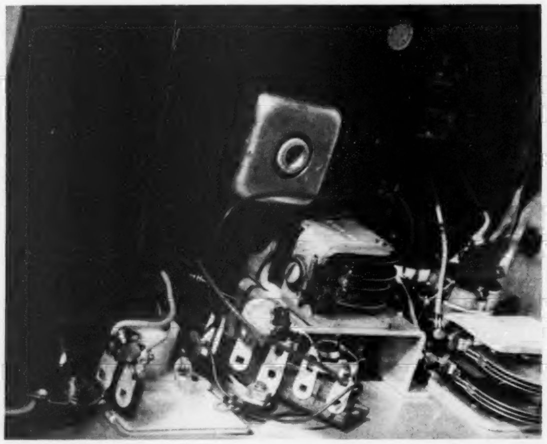

Photo C. Terminal strip holding the S-meter parts. The grain-of-wheat bulb is barely noticeable behind the meter's face.

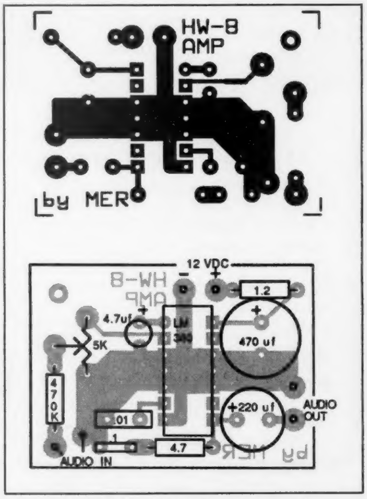

Figure 3. (a) PC board foil pattern for the audio amplifier. (b) Parts placement.

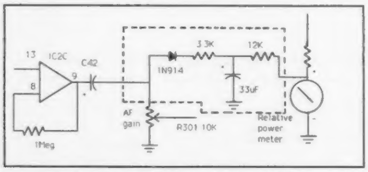

Figure 1. An S-meter for the HW-8.

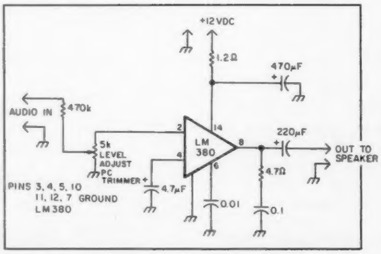

Figure 2. HW-8 audio amplifier. PC boards are available for $3 + $1.50 postage from Far Circuits, 18N640 Field Court, Dundee IL 60118.

than two resistors, a diode, and a capacitor.

Here's how it works. We steal a small amount of audio from the volume control at the junction of C42 and the pot. The diode rectifies the audio while the 33 µF capacitor smooths out the signal. The DC level is then connected to the plus side of the meter via the 12k resistor.

You may want to change this value to suit your needs. I found the 12k value to work well for me. This S-meter does not in any way affect the operation of the meter during transmit. The louder the signal, the more the meter moves. No one is really S-9, but the meter can be used to center the VFO to the audio filter by tuning for maximum reading. Besides that, it is great to watch the meter do something when the HW-8 is receiving.

Wanting a simple method for driving a speaker is nothing new for the HW-8. Here is my version based on the LM380, a 2 watt audio chip. This chip has lower internally generated noise than the popular LM386. The chip is widely used for audio power amplifiers in Ten-Tec radios. Here is my version, simple and easy to get running. Not much need to explain how it works. Audio from the headphone jack is routed to the amplifier board. A 5k trimmer adjusts the level going into the board. I wanted to be able to operate both the internal power amplifier and the headphones, whenever desired.

I adjusted the trimmer to supply a good level to the headphone jack and the internal amplifier. A small circuit board was used. One-hole mounting or a piece of double-sided tape works well, too, with the board mounted close to the headphone jack.

The power plug on the HW-8 has six conductors, of which only two are used for power. Here I took advantage of the extra pins and routed the power from the HW-8 to the audio amplifier via the power plug.

The power switch is external to the HW-8, and is in fact part of the power plug. The audio to the speaker is also routed to the last two pins—no need to drill holes in the HW-8 this way. By making up two different power plugs, you can run with headphones-only in the woods, then return home and plug into the internal audio amplifier and external speaker.

After these simple modifications, the HW-8 was back to its former self, banging out QSOs one after another. So what does this all lead to, you ask? Well, don't you know, there are many more modifications for the HW-7, HW-8, and the HW-9 in the HW-8 *Handbook*. Get your copy from me for $7.95 plus $1.00 postage at the address above.

What's in store for next month? Beats me. I'm heading out to the local K-Mart with my camera. Heard on the scanner that Elvis was seen there working in the shoe department. What a country!

Special Events

Continued from page 58

the largest hand-cut stone building in North America. For certificate send QSL and 9x12 SASE to ***C.A.R.A., 303 Spring St., Weston WV 26452.***

OLD FORT SUMNER, NM The Eastern New Mexico ARC will operate KA5BAT 1500Z–0100Z from the Billy the Kidd Museum in commemoration of the 110th anniversary of the demise of Billy the Kidd. Operation will be on the General phone bands on 15, 20, 40 meters, and around 28.400 on 10 meters. For a certificate, send QSL and a 9x12 SASE to ***Leroy Thomas KA1ULG, 1479A Mindoro Ct., Clovis NM 88101.***

JUL 13-14

FULTON, NY The Oswego County AR Emergency Service, will operate KY2F, 1300Z–1900Z Sat. & Sun. from the Central New York International Air Show at the Oswego County Airport. Operation will be in the General 20, 15, 10, and 2 meter bands and the Novice portion of 10 meters. For certificate, send your QSL card and a large SASE to ***Fred Swiatlowski KY2F, PO Box 5227, Oswego NY 13126.***

JUL 14

HASTINGS, EAST SUSSEX, ENGLAND The Hastings Electronics and Radio Club will operate Station GX6HH/P to demonstrate amateur radio to girls (aged 11–18) and visitors at a Grand Fete at Helenswood School on the 14th. They will also be QRV on July 13th. The girls will be designing their own unique QSL card which will be sent for each contact. QSLs to be via ***Gail P. Stevens G0GRK, 33 Langham Rd., Hastings, East Sussex, TN34 2JE, England.***

JUL 20-21

HAMBURG, NY The South Towns ARS will celebrate the 106th "Birth of the Hamburger" with club station WB2ELW operating 80 through 15 meters lower portion of General phone and 28.415. For QSL and commerative certificate, send SASE to ***WB2ELW, 6120 McKinley Parkway, Hamburg NY 14075.***

LAKE ITASCA, MN The Paul Bunyon ARC will operate a Special Event station Sat. from 0000Z–0000Z Sun., from the source of the Mississippi River, in commemoration of the Centennial of Itasca State Park and the State Park System. Operation will be SSB in lower part of the General range on 80–10 bands (excl. WARC). For a multi-color 8½ x 11 certificate, send QSL, SASE and contact number to ***KE0RR, Rte. 1 Box 152, Winger MN 56592.***

JUL 27–28

CANTON, OH The Canton ARC will operate Station W8AL to celebrate the Pro Football Hall of Game Greatest Weekend from 1300–2300 UTC Sat. & Sun. Frequencies: 28.350, 21.350, 14.270 and 7.270 SSB, ±QRM. SWL's welcome. For an unfolded certificate, send your QSL and a 9 x 12 SASE with two units of First Class postage. For a QSL or folded certificate, send your QSL and a #10 business size SASE to ***Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306.***

PORT HURON, MI The Eastern Michigan ARC will operate Station K8EPV from 1400–0200Z Sat. & Sun., to commemorate the 66th Port Huron to Mackinac Island Yacht Race. Frequencies: 3.910, 7.235, 14.235, 21.335. Phone 28.335; CW 3.710, 7.110 and 21.220. For certificate, send large #10 SASE with your QSL to ***Eastern Michigan ARC K8EPV, H. Kohl, 1640 Henry, Port Huron MI 48060***; or ***801 Range Road, Port Huron MI 48060.***

ROCKLAND COUNTY, NY The Crystal Radio Club, in celebration of its 60th Anniversary, will operate W2DMC from 1200–2400 UTC July 27th and 28th. Phone: 7.250–, 14.300–, and 28.450 MHz. CW: 7.050– and 14.050 MHz. For commemorative certificate, send QSL with SASE to ***W2DMC, PO Box 482, Valley Cottage NY 10989.***

JUL 28

EAST AURORA, NY The Pioneer Radio Operators Society will operate N2IFG from the village park during its 15th annual celebration of East Aurora "Racing Day," remembering its heritage as the trotting horse capitol at the turn of the century. Frequencies will be 3853, 7244, 14244 & 21344 kHz from 1600–2200 UTC. For a special QSL send a SASE to ***N2IFG, 42 North Willow St., East Aurora NY 14052.***

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Knobs, Buttons and Switches

No matter what kind of gear you're running, one thing is sure: It is controlled through switches and/or knobs of some kind. Even computers, with their inherent software approach, get down to human business via buttons, mice, keyboards, or some other mechanical arrangement. Until practical voice input control comes along or touch screens become popular, knobs and switches will continue to be the way to go.

Given their mechanical nature, it is not surprising that switches and controls are frequent sources of trouble. Many times, a "serious" problem will turn out to be nothing more than a dirty control or a flaky switch. Let's look at how and why these things happen and how to find and fix them.

On Again, Off Again

Simple on/off switches, which do no more than make and break circuits, come in a variety of styles. Each type is subject to its own peculiar failure modes.

Toggle switches, similar to the normal "light switch" style, rely on contact pressure for connection. The actual contact is usually on the side of the switch opposite the handle's pointing direction, because the handle is pivoted at its midpoint. The pressure, applied by a spring in the handle, is usually considerable.

The most common causes of failure of toggle switches are contact corrosion and bending of the contacting element. I've seen both. Corrosion is nearly always caused by excessive current through the switch, especially if it is applied while the switch is being turned on or off. (And after all, that is the point of a switch, right?) The effect is a "blackening" of the contact points and a poor or nonexistent connection, no matter how much pressure is applied.

An extreme example of this phenomenon occurs in really heavy-current applications like HF linear amplifiers. If the switch is turned on precisely when the AC current phase coming from the wall happens to be at its peak, the inrush current can be enormous, and the switch can actually weld itself permanently closed! My MLA-2500 amp has done this several times. Once it happens, the only way to shut it off is to unplug it!

Even then, the switch remains firmly welded "on," although this particular one can be pried apart with a screwdriver because its innards happen to be accessible. The best cure is a new switch, but it, too, can be welded in short order. When replacing a welded switch, always use the highest-rated one you can get, and make sure that it is rated for more current than the one you're replacing. On my amp, I've taken to using an outboard switch on a heavy-duty power strip.

Another cause of corrosion, more common in slide switches but also seen in toggles, is the drying out of the original lubricant. I don't know the name of this stuff, but there is a grease-type substance applied to many switches' contacts (especially those of Japanese origin), and it dries out over a period of five or more years. When dry, it resembles a hard black tar, and it is *not* conductive.

Assuming you can get the switch open, the obvious temptation here is to scrape the contacts clean. Beware: Many switch contacts, especially the high-current-capacity type, are plated. Scraping usually will remove the plating along with the problem. The switch may work fine, but it won't work for long. Without the plating, it will quickly corrode and go bad. If you *must* scrape, do it as carefully as you can, with fine sandpaper.

Another approach is to dab on a small amount of a powerful tarnish remover, such as Tarn-X™. This stuff is basically diluted acid, and it will clean those contacts to like-new status. It may also eat through the plating and the nonmetallic switch components, so be sure to wash your work off with plenty of water after a minute or so of the tarnish remover. Also, read and follow all the warnings printed on the bottle; this is not stuff you want to be careless with.

Slide on Over

Probably the most troublesome type of switch is the slide switch. These beasties are used for many things, including transmit/receive switching and band switching. They are chosen for these jobs because they can easily be made to have many poles which all switch at once, but they are much smaller than rotary switches. A big slide switch may have six or even 10 or more poles, each one a double-throw, yet be small enough to fit into a miniature radio.

The prevalent failure mode in slide switches is corrosion. Although their connections depend on the pressure of tiny fingers sliding along a long bar, the contact pressure really isn't strong enough to keep things clean through the resulting scraping motion. The fingers seem to keep their springiness for many years, but the bars get quite ugly. The primary cause seems to be that darned lubricant again. Also, simple oxidation and, of course, cigarette smoke residue take their toll. If you have an intermittent band switch, check its connections to the board first. If they are OK, the likely cause is contact corrosion.

Radio Shack and others sell sprays which are supposed to degrease and clean switch contacts. My success with them has been marginal at best. Sometimes they can help in a switch which has just started to malfunction, but usually they have no lasting effect. And I have yet to find a spray which will dissolve that black hard lubricant tar.

So, what's to do? Far and away, the easiest and best solution is to get another switch! It may look like a big hassle to replace a six-inch-long band switch with 30 contacts but, believe me, it is easier than the emergency method I am about to describe.

Ready, Doctor?

OK, you've got a bad band switch and you either can't get another one (you mean they don't still stock parts for that Yamasutsi 1972 special??) or you don't want to wait through the long ordering process. I ran into just such a case with a Panasonic shortwave receiver made in 1978. It was a nice little radio, but the band switch had gone bad, resulting in its not doing much of anything at all. Spraying did no good, so I decided to take the plunge and do surgery on the switch. Be warned: This is not for the faint of heart nor squinty of eyesight. Here's how to do it.

The first order of business is to remove the switch from the rig. Get some desoldering wick and carefully disconnect the offender, contact by contact. Usually, the metal body of the switch will be soldered at its corners to ground traces on the board, and you'll have to unsolder those, too. Once you have the switch out of the rig, the fun begins.

The bottom of the switch will probably be made out of a plastic or phenolic material similar to that used to make printed circuit boards. Extending around it at the edges will be metal tabs protruding from the metal top shell. Very carefully, bend the tabs back just enough so that you can remove the casing. Don't bend them all the way—it isn't necessary and greatly increases the risk of their breaking off. Now, gently pull the shell away from the bottom. Be prepared for some of the internal switch fingers to fall out. They are quite small, and if you lose one, you have ruined the switch! Keep a cup or other container handy to store them. Also, if the slider is spring-loaded, uncontrolled release can result in switch parts all over the room! Go slow.

Most of the fingers probably will still be on the center rods. Gently pull them off and put them away. The objects of your attention are the flat center rods around which the fingers were clasped. Most likely, the rod surface will be brown or black. This is the stuff you want to remove. Probably the best method is the tarnish remover. Clean everything up, wet it down and let it dry completely before proceeding. While the piece is drying, take a look at the switch fingers you removed. They should look OK but if they don't, try wetting a piece of paper with some spray contact cleaner (*not* tarnish remover) and sliding it between the fingers. Be very careful not to bend them apart. Then, let them dry, too.

When you're ready to reassemble the switch, replace the fingers on the center rods. Look at the slider and you will see the indentations where the fingers belong. You must position the fingers on the rods such that they will line up with these indentations. Don't try putting the fingers into the indentations and then pressing the whole thing onto the rod; you will bend or break the fingers. If there's a slider spring, put it in place now. Line up the shell and gently try to push the phenolic into it. If it resists, one of the fingers probably is not lined up correctly. Never force the assembly or you'll break it. Reseat the finger and try again. This is the most difficult part of the operation.

Once you've got it back together (and you're sure it's right), press the shell's securing tabs back over the phenolic and you're all set. The switch should be good as new! As you can tell from the description, this procedure is risky and hardly worth the effort unless you have no choice. But I've used it a number of times and saved some nice gear.

Around and Around

Rotary switches are basically round slide switches, and they suffer similar failures. They present some unique problems, though, because their construction can make access difficult. If you can get to the problem, which is almost certainly corrosion, try some cleaning spray. If that won't do it, dab on the tarnish remover. Unfortunately, you usually can't wash the switch off properly afterward, because it is still in the rig! Dab as much water on as you can and pat it off with a paper towel. Needless to say, let it all dry *completely* before turning on the power! I don't recommend disassembling rotaries, or even trying to remove them from the rig, especially if they are of the multi-level type, which most are. It's just too difficult, and the chances of getting it all back together again without causing other damage are small.

Push My Buttons

Push-buttons come in many forms, from the old-fashioned round long-travel type to the modern membrane variety. Some push-buttons are really slide switches in disguise. A quick peek behind the front panel will tell you for sure. The old long-travel types are so plentiful that it just doesn't pay to try to fix them. Besides, I've never had much luck with fixing one; the switch always wound up working, but not reliably.

Membrane switches, as used on modern HTs and HF rigs, are very reliable. The usual cause of failure is from having something (typically soda) spilled into them. If you can, order a new keypad. If not, you can often pull them apart by peeling the adhesive layers from each other. A good cleaning with some tape head cleaner will usually restore these pads to normal. Just be sure to line the two halves up properly before you press them back together.

See the Light

Optical encoders, used for tuning today's microprocessor-controlled HF rigs, are not mechanical switches at all. They employ a pair of LEDs and photodiodes in an interrupter arrangement. As you spin the dial, a slotted plate alternately passes and interrupts the light to the photodiodes. Each blip of light represents some fraction of a turn. The direction of the rotation is determined through a clever scheme: The light paths are arranged so that one changes state while the other is halfway through its position. Rotating the dial clockwise will cause one photodiode to detect a change before the other, while rotating counterclockwise will reverse the order. It is a simple matter to decode the changing states into direction and speed information. By the way, most computer mice use this arrangement.

The usual cause of failure in optical encoders is electronic, rather than mechanical. Either an LED or photodiode goes bad, or the associated decoding circuitry fails. In either event, new parts are called for.

Well, there are several other kinds of switches, including microswitches and relays. Also, there are potentiometers, and they are among the most troublesome of all components. We'll continue this exploration next month.

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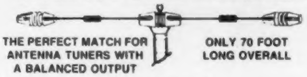

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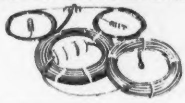

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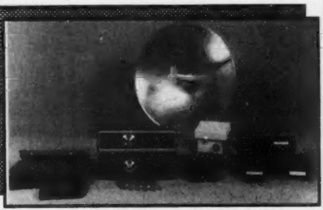

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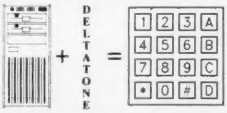

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Shuttle ATV Success!

During the STS-37 mission last April some record breaking contacts were made via 70 cm ATV. Six selected stations in all made the attempt to uplink live video to the orbiting shuttle during several passes over the U.S.

Considering that the shuttle was using a window-mounted antenna and the distances that needed to be covered (at times over 1500 miles), the uplink sites had to mount a massive effort to generate the most ERP (Effective Radiated Power) possible. The individual stations generally ran 400 watts or more. Some of the sites also used multiple antennas (or a 40-foot dish, in the case of the Goddard U.S. Naval Academy site—see the photo of this dish in the May "QRX" column). The stations making the attempt were Jim Steffen KC6A in Long Beach, California; the Johnson Space Center ARC W5RRR in Houston, Texas; Andy Bachler N9AB with the Motorola ARC in Schaumburg, Illinois; the Marshall Space Flight Center ARC WA4NZD in Huntsville, Alabama; Goddard Space Center ARC WA3NAN in Greenbelt, Maryland (the Goddard group also uplinked via the U.S. Naval Academy dish in Annapolis, Maryland) and Kai Siwiak KE4PT representing the Motorola club in Ft. Lauderdale, Florida.

The first scheduled attempt was unsuccessful due to the position of the orbiter. However, orbit 32 was a different story! Jim Steffen KC6A started out the pass with great reception by the *Atlantis* even when it was far out over the Pacific Ocean. Jim was running a K2RIW amplifier running 600 watts into a single KLM-18C. Next, the Marshall group WA4NZD sent some excellent video up to the shuttle showing the club members who helped set up their station (see the June "QRX" section for a picture of the group and their antenna system).

Andy N9AB next sent up a video tape of the liftoff of the *Atlantis*. This marked the first time any shuttle crew has been able to view their liftoff while still in orbit! Andy was one of the furthest stations away from the orbiter due to his northern location near Chicago (elevation angles of only a few degrees). He ran a kilowatt into a 16-bay array of quagis to make up the difference.

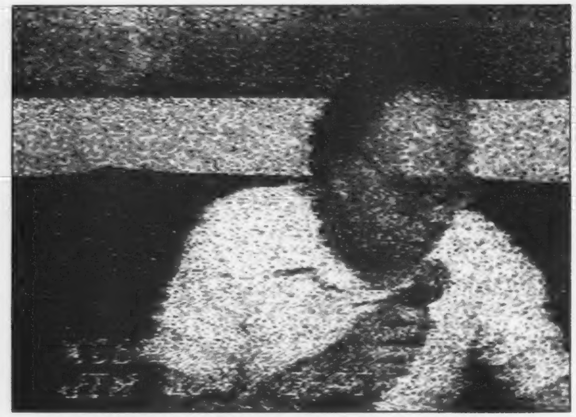

Photo A. Jim Steffen KC6A as received by the shuttle Atlantis.

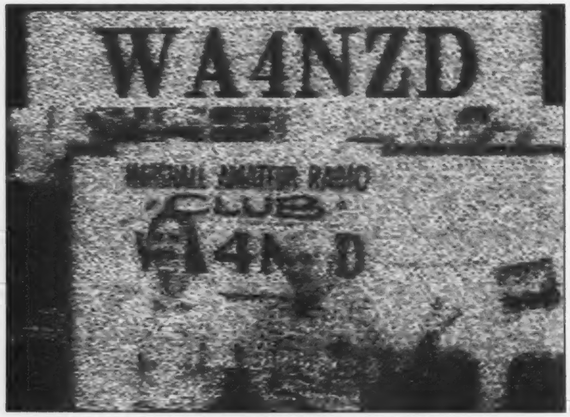

Photo B. The Marshall Amateur Radio Club sends their best to the shuttle.

Photo C. N9AB reception by the shuttle. Eighth grade student Chelsea Paparigian (Millburn School in Wadsworth, Illinois) makes her debut as simulated mission commander.

Photo D. A nearly snow-free signal in full color was received from the Goddard/US Naval Academy effort WA3NAN.

Due to the success of this scheduled uplink, the next morning another opportunity was made available. The crew on board *Atlantis* first received a taped uplink from N9AB of a local school's shuttle mission simulation (the Millburn School in Wadsworth, Illinois). Next the Goddard/U.S. Naval Academy group was able to send up a nearly snow-free COLOR signal. Of course, the Henry amplifier and the 40 foot dish may have helped a little! At the end of the tape recorded on board the shuttle, a very weak image of a SAREX patch could be discerned. This was sent by Kai Siwiak KE4PT in Ft. Lauderdale, Florida. The Johnson Space Center ARC W5RRR video effort was not seen on the shuttle's videotapes (although it may well be viewable upon further analysis). The JSC effort was undertaken by T. Brad Smith KA5CDJ and others in the club.

Thanks to the efforts of Gerry Creager N5JXS, we can show you still frames of the actual videotape as received on STS-37. Gerry printed Photos A–D out on a SONY UP500B videoprinter. While they may seem rather snowy at first glance, keep in mind that the actual video appears clearer since the eye tends to average out some noise.

How It All Began

After the SSTV experiments on STS-51F by Tony England W0ORE, fast-scan TV seemed the next logical step. Back in early 1987, Andy Bachler N9AB discussed the idea with Lou McFadin W5DID and decided that the experiment would be feasible. The Motorola ARC (Illinois chapter) put together a proposal (building on a previous proposal by Art Anzic K8BVI from the NASA Lewis Center) and Andy submitted it in May of that year.

While the FSTV project was underway, a need for a new side-window-mounted shuttle antenna for the STS-35 mission arose. A dual-band antenna which allowed simultaneous 2 meter operation and 70 cm FSTV receive was designed and built by Jim Phillips and Andy Bachler N9AB at Motorola in Schaumburg, Illinois.

Bill Bily WB9DIG built the prototype shuttle ATV downconverter using parts of a Motorola HT and TV IF circuitry suggested by Tom O'Hara W6ORG. With the aid of Fred Reimers N9ETW (also known as FAR Circuits), the downconverter was built on a custom PC board to produce a very compact package which integrated nicely with the rest of the SAREX equipment.

Future Possibilities

Enhancements to the shuttle's receive system and ground station capabilities should result in even better performance in future missions. A lot has been learned by this experiment, and it's hoped that it can be flown again in the near future.

Photo E. Marshall Amateur Radio Club members with their four-bay helix array in background. (l to r): Ed Stluka W4QAU, Don Hediger N4MSN, Eddie Crawford WA4QKC, Gene Marcus W3PM, Terry Jones NZ8C, Tim Cunningham N8DEU, Randy Galloway KN4QS, Larry Savage WA4CAX and Dick Christiansen KK4HF (behind the video camera).

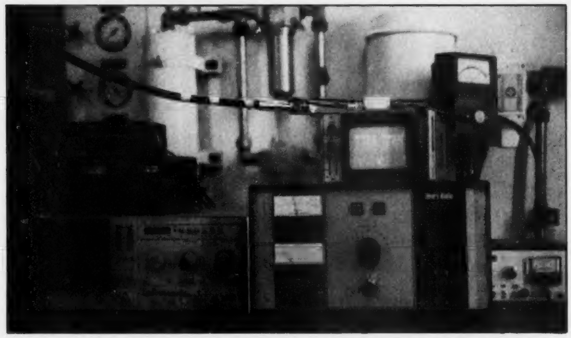

Photo F. Pure power—the uplink transmitter at the U.S. Naval Academy/Goddard site. Combine this with their 40-foot dish and watch out! Photo by Bob Bruninga WB4APR.

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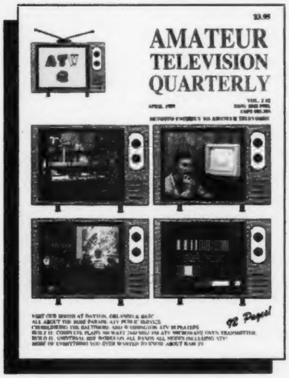

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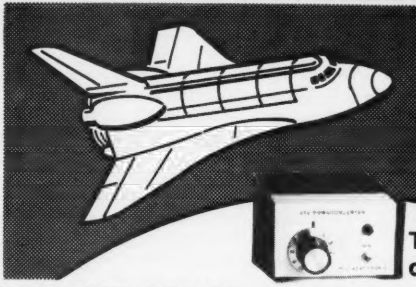

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Fastnet Rock Lighthouse

Look for a unique expedition this July from the Fastnet Rock Lighthouse just off of the southern coast of Ireland. As one of Europe's most westerly and loneliest outposts, the lighthouse has been an important gateway for transatlantic shipping since 1854. Since the "Rock" is lashed by the full force of Atlantic gales (even during the summer), a boat landing is possible only 12 times a year. The group plans to ferry all radio equipment and supplies over by helicopter on July 9 and continue operations for 10 days.

The expedition will operate under the callsign EJ7FRL (Fastnet Rock Lighthouse) on the following frequencies: SSB—3.775, 7.075, 14.140, 14.240, 21.275, 28.450 and 144.260 MHz. CW—3.510, 7.010, 14.010, 14.030, 21.010, 21.030, 28.010, 28.030 and 144.040 MHz. Also look for the group on 160m and the WARC bands. The IOTA (Islands On The Air) reference number is EU-121. QSL via EI2BB. *[Thanks to EI3GU for the above information.]*

More DX Techniques

No doubt you heeded my suggestions made in last month's article, and listened very carefully to each DX station before calling. Remember, I said *listen, listen, listen*!

Yes, listening is the name of the game, then putting your signal where the DX station is listening. You must understand what the operator is going to do next, how the operator is working stations, and where the operator is listening. Otherwise you will be playing DX roulette, and you will probably spend many frustrating, even fruitless, hours calling, calling, and calling, but never working the DX station.

If the DX station is working stations in split mode (he is working stations above or below his own transmit frequency), you should find the stations he is working, and note whether these stations are on the same frequency, or higher or lower, each time.

An experienced DX operator with a reasonable pile-up will work stations progressively higher (or lower) in frequency each time until he reaches the limit of his "listening window," which may be 5 to 10 kHz wide, or even wider. When he reaches the limit of the window, a DX operator will usually move back to the beginning of the window and start moving up (or down) in frequency again. A rare DX station will usually have a large to gigantic pile-up to work, and may be listening over a much larger window, up to 50 kHz wide. The wider the window, the more difficult it is for us to work the DX station.

It is very helpful if you can monitor both the DX station and the pile-up simultaneously. Some modern transceivers offer this capability, otherwise you must use an extra receiver. You can drive one earphone from one receiver and one from the other receiver.

As soon as the DX station signs over to a station, start searching the pile-up to locate the lucky operator. But don't be fooled by the odd operators who send "599" or "59" and are not actually working your DX station. There are always a few in every pile-up who insist on confusing matters by sending bogus reports. There may also be other QSOs taking place within the window, or more than one pile-up taking place in the same area of the band.

Second Guessing

Okay, so you have found the stations he is working. If you are lucky, you can transmit on or near that frequency and work him. But it is better to listen to several contacts and determine just how far he moves his receiver each time, and whether he is working more than one station on each frequency before moving on. You are trying to guess what he will do next.

When you have determined his pattern, you are ready to put your callsign on the correct frequency and hopefully work him within a reasonable period of time.

One suggestion—if you are calling, but haven't worked him within a reasonable period of time, say 15 to 20 minutes—either you may not have figured out his pattern, or you have, but too many other DXers also have. Another possibility is that propagation is not favoring your area. Take a break. Come back to the pile-up in 15 to 20 minutes with a new attitude—listen, learn his pattern, and get him!

If you have been unable to figure out his pattern, you may sit on one frequency and call each time he says "over" or "QRZ." This is a poor technique, but sometimes it works. Though this is an unsophisticated technique, it is especially effective if you have a commanding signal and are on a relatively clear frequency. I have worked several DXpeditions this way when I could not figure out the pattern, but knew they were tuning through a window of frequencies.

It is also a useful technique to use for a DX station who insists on spreading their pile-ups over a large window or who use a channel technique where the operator listens only on spot frequencies (channels) located every 10 kHz or so. This so-called channel technique can be extremely difficult for calling stations, and usually spreads the pile-up over a large portion of the band, since most of the calling operators don't know the channel technique is being used.

Pile-up Don'ts

There is also a long list of pile-up don'ts.

Don't make long calls; keep your calling sequence short and sweet, especially if the DX station is working stations very quickly.

Don't transmit on the DX station's frequency if he is working split. No matter what you say, someone will almost always respond, often in an unkind or insulting manner.

Don't respond to jamming or insults.

Don't transmit when the DX station is transmitting.

Don't transmit when the DX station requests a particular callsign fragment ("W5K," "last letter echo," "Europe only," etc.) unless, of course, the request matches your callsign or geographical location.

Don't mention your name, QTH, etc., unless the DX station requests such information.

Next month we'll discuss some techniques for special situations and go over some DXing how-to books. ■

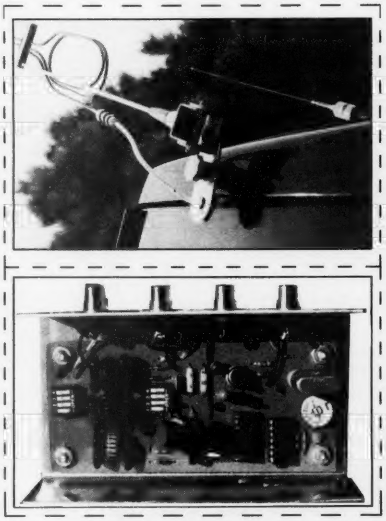
Photo. The Fastnet Rock Lighthouse expedition (southern Ireland).

Number 30 on your Feedback card

UPDATES

June Photo Switcheroo

As we were all on our way to the Dayton Hamvention, the gremlins decided to have a little fun with two of our articles. In the June issue, Photo A on page 10 and Photo A on page 34 somehow got mixed up. To correct this, we offer a cut-and-paste solution! Since the photos are the same size, just cut out the attached photos and paste them in the correct article. If you don't want to cut up your magazine, just photocopy them.



In the June issue, the top photo should be placed over Photo A on page 34. The bottom photo should be placed over Photo A on page 10.

Michigan Scanner Law

See the May "QRX." John Evanish N8LBD writes: "In your 'QRX' in the May '91 issue on scanner law, you said [Michigan] law exempts licensed amateurs except for Novices and Technicians. This is incorrect."

According to a copy of H.B. No. 4750, Sec. 508, which John N8LBD sent with his letter, Technician Class operators are also exempt. ■

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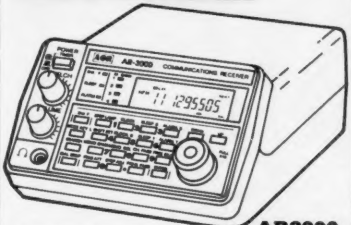

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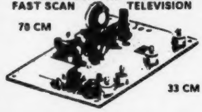

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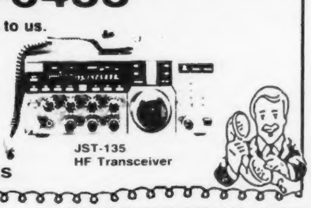

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REFERENCE

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10M44 **World Atlas** *by Radio Amateur Callbook Inc.* 20 pp. of full color, 8¾" x 10⅞", contains North Polar projection of the world; maps of all seven continents, West Indies/Caribbean area, and Pacific Ocean. **$5.00**

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PACKET

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5 wpm—This is the beginning tape, taking you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

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UW0791

Number 31 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Odds and Ends

I met several hundred of you at Dayton this year. Thanks for all the kind words about the magazine and this column.

—•—

Radio Fun is succeeding beyond even Wayne's wildest dreams (and Wayne has some pretty wild dreams!). The premier issue sold out in about three weeks, though your local ham store may have a few copies left. Subscription orders are coming in by the bagful every day. Look for the start of monthly publication with the September issue.

—•—

Despite the fact that our advertisers are reporting incredible sales from their ads in *73*, there are several companies that remain conspicuous by their absence from these pages. Companies like Ten Tec, Cushcraft, Radio Shack, Kantronics, Standard, Ham Radio Outlet, Henry Radio and Optoelectronics continue to ignore the fact that advertising in *73* will make money for them.

Some of the advertisers who *do* take out space in *73* will take out two or three times the space in *QST* or *CQ*. Why? I've always maintained that *73* readers spend more money than readers of other ham magazines. Many of our advertisers have recently reported this to be exactly the case. If you, patient reader, want to see a fatter *73*, it's up to you to make sure every amateur radio advertiser knows that you read *73*. That means that when you call a company for information, tell them you saw their ad in *73*. When you order a piece of gear, tell the person on the phone or behind the counter that you saw the ad in *73*. If a company is not advertising in *73*, write or call them and tell them you're interested in their product, but since they don't advertise in *73* you have no idea what they offer. It's no mystery . . . ad pages pay for editorial pages on a roughly 50/50 basis. When we have more ad pages, you get more great reviews, construction projects and all the other stuff you want. Give the above named companies a call—and any others you come across—and ask them why they're throwing away perfectly good money by not advertising in *73*. Then call me and let me know what they tell you.

—•—

I have a source at the FCC in Washington who informs me that there are several countries who are preparing WARC 92 proposals that would take away the entire 40 meter band. No, I'm not kidding. My source also informs me that many countries around the world are making recordings of American hams on 14.313 and the phone portion of 80 meters. They are planning to submit these recordings into the official proceedings at WARC 92 to support their proposals asking for the re-allocation of HF amateur frequencies to other services. Remember, every country gets only one vote at WARC. That means that when it comes down to the final tally, we have the same power as any small African, South American, Asian or Middle Eastern country (and these smaller nations desperately want our HF spectrum). While we Americans exercise our First Amendment right of free speech on the HF bands, we all ought to remember that other countries do not enjoy nor understand such a permissive right. With the right to speak freely comes the responsibility to use that right wisely. Think about it.

—•—

Donna DiRusso, the *73* Advertising Accounts Services Rep for the past three years, has been transferred over to one of Wayne's other magazines (*CD Review*). Donna has been the person who makes sure our advertisers are happy and she has done an outstanding job. We will all miss her very much. Sue Colbert is taking Donna's place at Ad Account Services. She is already cracking the whip and letting Dan and Louise (the *73* ad sales dynamic duo) know who's boss. Welcome to The Team, Sue.

—•—

My wife and I just bought our first house, so it looks like you're all stuck with me for at least the next 30 years (unless you want to help pay off some of the mortgage). It's a traditional Cape, nestled among the trees (but not too many trees), perched on top of a hill on three-and-a-half acres. The lot is a ham's dream. Oddly enough, a good radio sight was not one of the things we were looking for. It just happened that way. Really!

—•—

There's a group of hams down in Houston who are doing a great job of promoting amateur radio. They're called the Houston Amateur Radio Helpline and they've got some very nice PR pieces. If you want to see what can be done with a little imagination and very little money, drop 'em a line at 16410 Havenhurst, Houston TX 77059-5307. Their phone number is (713) 488-4HAM. Congratulations to the Houston area hams. We need more like you.

—•—

I was reading in one of the amateur radio news bulletins (I forget which one) about an organized effort by some packet radio groups to get the FCC to fire the guy who wrote the citations for passing commercial traffic on packet (remember . . . the 900-line message that circulated during Operation Desert Storm). Will someone please tell these people to knock it off. The last thing we need is to be causing the FCC more headaches with this kind of petty crap. The guy was just doing his job. He may have had some personal motive behind his actions, but I haven't seen any proof. The fines have been cancelled anyway, so what's the big deal? This gentleman did us a favor by showing how vulnerable our packet system is. So, instead of doing the typical stupid ham thing of screaming and yelling for this guy to lose his job (give me a break!), why don't we learn from this experience and either clean up our act or get a rule change?

—•—

As reported widely last month, there's a ham in Ohio who is in a whole kettle of hot water for interfering with police and other emergency communications. This guy apparently had a pretty sophisticated setup, with taped sirens for background noise and thousands of dollars of modified radio gear. His favorite game was to make a false "officer in distress" call, then watch the "fun" as a whole police department went into a panic trying to find an injured police officer who didn't exist. The thing that burns me about this whole story is the fact that this guy is a high school teacher and advisor to the high school radio club! Unbelievable! I hope this guy gets the psychiatric help he so obviously needs. I also hope that, if found guilty, he rots in a jail cell for a very long time.

—•—

Why is it that amateur radio manufacturers often advertise great looking new gear several months before it is available? I can understand advertising a bit in advance to generate interest, but some of our better known companies are taking this to ridiculous extremes.

—•—

I spend a lot of time on the air. If you ever hear me, don't hesitate to break in and say "Hi." If I'm home (and not mowing the three-and-a-half acres) on weekends, look for me on 40, 17 or the Novice or FM portions of 10. I usually check 28.365 MHz on the half hour, so try giving me a call. If you're a night owl, you can often catch me gabbing with N1GVA, N1GOJ and NU1W after midnight around 3.915 MHz (Friday or Saturday nights are your best bets). You can also find me on RTTY on 10, 15 and 40. Try the RTTY portion of 15 first. It's my favorite RTTY band. Don't be shy. I'd love to meet you.

Number 32 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

There's some exciting news this month: a total solar eclipse on July 11. The path of total darkness will cover the Hawaiian Islands and portions of Mexico. A partial eclipse will be viewable in S.W. Canada, the United States, except for the tip of Maine; Mexico and Central America; and South America, except for the Tierra del Fuego area. Then, on July 26, there will be a penumbral eclipse of the moon, which means it will only be in partial, not complete, shadow.

Propagation conditions during July ordinarily exhibit what we call the summer doldrums, since the HF bands for DX are not as lively as they are in spring and fall. Yet some excellent propagation can occur this month, so don't give up! July is typically a vacation month, and lots of hams will be portable or mobile on the HF bands. Expect plenty of short skip, especially on the most-used bands of 15 and 10 meters, but also on 20 and 40 . . . and some DX, too.

As this is being prepared (late March, early April), the sun has been showing some remarkable activity. For the past month or six weeks, solar flux has been very high—more than expected—in the 200–300 flux units range. Also, there have been numerous large spot groups on the solar surface facing earth, accompanied by major flare activity. On some days, two and three major flares were recorded, and polar cap disturbances and proton events on earth or near earth have been numerous. Following the flares by two or three days, DX has been especially good on all HF bands, not bad considering Cycle 22 is now on the downswing. However, the spot groups are nearing the solar equator, a sure sign that Cycle 22 is drawing to a close.

Conditions this month ought to be fairly quiet, with fewer flares and magnetic field disturbances on earth. The 8th through 11th, and the 22nd through the 29th, are anticipated to be poorer days for propagation than the remainder of the month. As always, check WWV or the latest forecast at 18 minutes after each hour. Use the band-time-direction chart for planning your best times for DX operaton, and use the daily conditions chart to guide your decisions. Let me know how the eclipses affect propagation in your area. See you next month.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	15/17(1)
ARGENTINA	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12	10/12
AUSTRALIA	15/17	15/17	—	20	20	—	20/40(1)	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
ENGLAND	20	20	20/40	—	—	—	—	15/17	15/17	—	15/17	20
HAWAII	15/17	15/17	20	20	20	20	20	—	—	—	—	10/12
INDIA	20(1)	20(1)	—	20(1)	20(1)	—	—	—	—	—	—	15/17(1)
JAPAN	—	—	—	—	—	20	20	—	—	—	—	15/17(1)
MEXICO	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
PHILIPPINES	—	—	20	—	—	20(1)	20(1)	15/17(1)	15/17(1)	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
SOUTH AFRICA	—	40(1)	20	20	20	—	—	15/17	15/17	20	—	—
U.S.S.R.	20	20/40	20/40	—	—	—	—	—	—	15/17	15/17	20
WEST COAST	15/17	15/17	40/80	40/80	40	40	40	—	20	15/17	15/17	15/17
CENTRAL UNITED STATES TO:												
ALASKA	15/17(1)	—	—	—	—	20	20	20	—	—	—	15/17(1)
ARGENTINA	15/17	15/17	20	—	—	20(1)	—	—	—	—	10/12	10/12
AUSTRALIA	15/17	15/17	—	20	20	—	20	—	—	—	15/17(1)	15/17(1)
CANAL ZONE	15/17	20	20	20	—	20	20	15/17	15/17	10/12(1)	10/12	10/12
ENGLAND	20	20	—	—	—	20(1)	—	—	—	—	15/17(1)	15/17(1)
HAWAII	—	—	20	20	20/40	—	20	—	15/17	15/17	15/17	10/12(1)
INDIA	15/17(1)	20(1)	—	—	—	20(1)	20(1)	—	—	—	—	15/17(1)
JAPAN	15/17(1)	—	—	—	—	20	20	20	—	—	—	15/17(1)
MEXICO	15/17	20	20	20	—	20	20	15/17	15/17	10/12(1)	10/12	10/12
PHILIPPINES	15/17(1)	—	20(1)	—	—	—	20(1)	20(1)	—	—	—	—
PUERTO RICO	15/17	20	20	20	—	20	20	20	15/17	10/12(1)	10/12	10/12
SOUTH AFRICA	—	—	20/40(1)	20(1)	—	—	—	15/17(1)	15/17(1)	20(1)	—	—
U.S.S.R.	20	20	20	20	—	20(1)	—	—	15/17(1)	15/17(1)	15/17(1)	20
WESTERN UNITED STATES TO:												
ALASKA	15/17	20	20	20	20	20	—	20	15/17(1)	15/17(1)	15/17(1)	15/17
ARGENTINA	10/12	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12
AUSTRALIA	10/12(1)	15/17	15/17	20	20	20/40	20/40	20	—	—	—	10/12(1)
CANAL ZONE	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
ENGLAND	20	20	20	20	—	20(1)	—	15/17(1)	15/17(1)	—	—	20
HAWAII	10/12(1)	15/17	20	20	40	40	20	20	—	15/17	10/12(1)	10/12(1)
INDIA	—	15/17(1)	15/17(1)	—	—	—	20(1)	20(1)	15/17(1)	15/17(1)	—	—
JAPAN	15/17	20	20	20	20	20	—	20	15/17(1)	15/17(1)	15/17(1)	15/17
MEXICO	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
PHILIPPINES	—	15/17(1)	15/17(1)	—	—	20	20	20	15/17(1)	—	—	—
PUERTO RICO	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
SOUTH AFRICA	—	—	—	20(1)	—	—	—	20(1)	15/17(1)	15/17(1)	—	—
U.S.S.R.	20	20(1)	20(1)	20(1)	—	—	—	—	—	—	—	20
EAST COAST	15/17	15/17	40/80	40/80	40	40	40	—	20	15/17	15/17	15/17

Notes: (1) Possible but rare dual bands (10 or 12, 15 or 17, 20 or 40). Try where shown. The highest possible bands shown. Also try next lower band at times shown.

JULY 1991

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 G–F	3 G–F	4 G–F	5 G	6 G
7 G	8 G–F	9 F–P	10 P	11 P–F	12 F–G	13 G
14 G	15 G	16 G–F	17 F–G	18 G	19 G	20 G
21 G–F	22 F	23 F–P	24 F–P	25 P	26 F–P	27 P
28 P–F	29 F–G	30 G	31 G			

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- One-Touch Instant Recall of Favorite Channel
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- 10 Battery Saving Sampling Rates
- PTT/Keypad Lock
- Includes: CSC-35 Vinyl Case, NC-28B 117 VAC Wall Charger, Belt Clip and FNB-17 Ni-Cad Battery.
- Accessories/Options: FNB-12S (5 Watts) Battery, MH-12A2B Speaker/Mic, MH-19A2B Mini Earpiece/Mic, MH-18A2B Lapel Speaker and LCC-25 Custom Leather Case.

YAESU
FT-411E
YAESU
FT-470
DUAL BAND

Specifications

Frequency Range: RX: 130–174 MHz, TX: 144–148 MHz (FT-411E); 430–450 MHz (FT-811); 1240–1300 MHz (FT-911)

Power Output: W/FNB-17: 2.5 Watts (FT-411E); 2.0 Watts (FT-811); 1.0 Watt (FT-911) — W/FNB-12S: 5.0 Watts (FT-411E); 5.0 Watts (FT-811); 1.0 Watt (FT-911)

Channel Steps: 5, 10, 12.5, 20 & 25 kHz

Case Size: 2.2(W) x 5.0(H) x 1.3(D) in.

Weight (Approx.): 13.4 oz. (FT-411E); 13.4 oz. (FT-811); 15.2 oz. (FT-911)

FT-470

Compact Dual Band 2m/70cm FM Transceiver

Compact... Powerful... Economically Priced. The FT-470 provides "true" Dual Band Operation so you can transmit on one band while monitoring or scanning on the other band.

Plus these features:

- 42 Memories
- 2 Independent VFOs
- Built-in CTCSS (Encode/Decode)
- Automatic Power Off (APO)
- Programmable Channel Steps
- Backlit Keypad and Display
- 10 Memory Auto-Dialer
- 10 Battery Saving Sampling Rates
- PTT/Keypad Lock
- Includes: CSC-43 Vinyl Case, NC-28B 117 VAC Wall Charger, Belt Clip and FNB-17 Ni-Cad Battery.
- Accessories/Options: FNB-12S (5 Watts) Battery, MH-12A2B Speaker/Mic, MH-19A2B Mini Earpiece/Mic, MH-18A2B Label Speaker and LCC-27 Custom Leather Case.

Specifications

Frequency Range: RX: 130–180 MHz, TX: 144–148 MHz (VHF); 430–450 MHz (UHF)

Power Output: W/FNB-17: 2.3 Watts (144 & 430 MHz) — W/FNB-12s: 5.0 Watts (144 & 430 MHz)

Channel Steps: 5, 10, 12.5, 20 & 25 kHz

Case Size: 2.2(W) x 6.0(H) x 1.3(D) in.

Weight (Approx.): 14.8 oz.

YAESU

*Performance without compromise.*SM

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17210 Edwards Road
Cerritos, CA 90701
Specifications subject to change without notice.
Specifications guaranteed only within amateur bands.

Talk to Your FT-911 Handheld with the New FT-912 Mobile

KENWOOD

KENWOOD
13:36
146.940
446.525

This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until approval of the FCC has been obtained.

Freedom of Choice

TM-741A Modular FM Transceiver

The choice is yours. Kenwood's new FM Multibander allows you to start as a deluxe dual band radio – or add a third band. As a dual band, you'll have access to 144 and 450 MHz operation.

If you decide to add a third band – choose again. Select from the 28, 50, 220, or 1200 MHz bands. Then simply plug this option into the available slot.

Your ultra-compact TM-741A offers a full 50 watts on 10, 6, and 2 meters; 35 watts on 450 MHz; 25 watts on 220 MHz, and 10 watts on 1200 MHz!

On 2 meters, you'll find wide band receiver coverage with RX on 118 - 174 MHz, and TX on the Amateur bands. The 2 meter section is modifiable for MARS and CAP (permits required).

303 memory channels are available, with 101 in any one band. Cross band repeat between bands, or, choose dual band input with cross repeat to the third band. The offset function is active on the output, allowing you to repeat to repeaters.

Other features

Individual volume and squelch controls for each band. Remote mounting of front panel with optional cable kit. Optional selective calling or group calling. Optional DTMF memory stores 15 characters for repeater controlling. Versatile scanning. Auto offset on 2m. Fixed detect output for packet radio.

Multi-function DTMF microphone. Separate antenna and speaker outputs. Auto power off and time-out. 4 step dimmer. 3 step power. Clock, timer and calendar. DC cable, and mobile bracket.

UT-28S: 28MHz, 50 W, RX: 24-36 MHz, TX: 28-29.7 MHz. **UT-50S**: 50MHz, 50 W, RX: 46-57 MHz, TX: 50-54 MHz. **UT-220S**: 220 MHz, 25 W, RX: 215-230 MHz, TX: 220-225 MHz. **UT-1200**: 1200 MHz, 10 W, 1240-1300 MHz. **DTU-2**: digital paging unit. **PG-4K**, **PG-4L**: remote cable kit. **MB-11**: extra mounting bracket. **PG-2N**: extra DC cable. **PG-3B**: DC line noise filter. **TSU-7**: CTCSS encode/decode unit.

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KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court
Mississauga, Ontario, Canada L4T 4C2

Kenwood meets or exceeds all specifications. Contact your dealer for a complete listing of specifications and accessories. Specifications are subject to change without notice. Complete service manuals are available for all Kenwood transceivers and most accessories. One year warranty in the U.S.A. only.

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